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FINANCE IN THE MINING INDUSTRY



A Staff Study Prepared by

E. K. CORK

for the Royal Commission on Banking and Finance

Working paper



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- Note:- (i) The opinions expressed herein are those of the author, and not necessarily those of his employer.
- (ii) The author is grateful for the generous cooperation of the Department of Mines and Technical Surveys and the Dominion Bureau of Statistics.

November 19, 1962.

Publication of this paper does not necessarily imply
that the Royal Commission on Banking and Finance agrees with
all of the analyses or with the views expressed.

TABLE OF CONTENTS

		<u>Page</u>
	Summary	1
<u>Chapter</u>		
1	Introduction	5
2	The Future of Canadian Mining	17
3	The Behaviour of Mining Stocks	29
4	Expenditures for Mining Exploration	35
5	Financing the Junior Exploration Companies	42
6	Financing of Mine Development	54
7	Sources of Capital	65
8	Rate of Profit, and the Effects of Taxation	72
9	Foreign Control in the Canadian Mining Industry	82
10	Refining and Fabricating Minerals in Canada	85



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Summary

There is in prospect in the coming decade substantial levels of world consumption for the products of Canadian mining. However the many glamorous projects of the past decade which were directly related to the cold war and rearmament will probably not be duplicated. Within such a general environment the amount of capital to be required for the industry will depend on the results of mineral exploration and possible decisions to process in Canada ores and concentrates now exported.

The general trend of exploration expenditures has been rising in the past decade, although the total now is less than in 1956 and 1957 when runaway metal prices and excited stock markets stimulated considerable activity. Because of the very high risk and tax considerations, most exploration is undertaken by companies of appreciable financial strength which do not depend on the stock market for funds.

Junior exploration companies, publically financed, require considerable regulation. Regulatory agencies could well maintain closer inspection of the affairs of junior exploration companies after as well as during primary distribution. Of the funds raised from the public by broker-dealers (over-the-counter) perhaps 60% go to their costs and profit and only 40% to the corporate treasuries. The costs are not so great for listed companies.

While the relative importance of junior companies in

exploration will continue to diminish, the juniors are not likely to disappear. Government should adopt wise rules to ensure full and honest disclosure to the public, including prompt and detailed reporting of trading by insiders.

Development of new mines will continue to be concentrated in strong hands. It is a risky business. Most of the funds invested are provided from abroad or from retained earnings of established mine development companies, (uranium was an exception, not likely to be repeated), so that capital expenditures for mining are not very sensitive to monetary policy. In excess of \$400 million is held as cash and equivalent by major mining companies, available for financing new mines into production.

Bank loans for mining are not large in relation to the size of the industry, in part because banks have not encouraged loans for capital purposes. A gap in the financial structure exists, in the area of lending funds for one to six years. Chartered banks could fill this gap by extending term loans. Such an improvement would encourage the growth of independent Canadian companies, and would tend to release some of the existing liquid reserves for real capital investment.

A generous prospective rate of profit is necessary to compensate for risk in developing new mines. Return of capital with 10% interest after taxes is a minimum, and three to five years repayment of original investment. Tax incentives are very important, and without them considerably fewer mines and related facilities would be developed.

Control is held abroad for 72.5% of the aggregate invest-

ment in Canadian mining, not counting influential blocks of stock which are not large enough to constitute formal control. Greater domestic participation and control in Canadian mining could be encouraged.

To achieve more processing of Canadian minerals in Canada is laudable but difficult. Progressive foreign tariffs and freight rates discourage export of manufactured goods, and most Canadian base metals are exported as ores, concentrates, or in a fairly pure but unfabricated state.

Increasingly metal producers around the world are turning to vertical integration as an aid to selling their products. As world trade becomes more closely knit the position of the unintegrated seller of metal or mineral will become increasingly precarious.

Chapter 1: Introduction

The Importance of Mining in the Canadian Economy:

In 1960 mine production in Canada (excluding sand, stone and gravel) amounted to \$1.3 billion, of which 80% was metals, 6% coal and 14% industrial minerals. In addition valued added in smelting and refining production (excluding cost of raw materials) was \$0.6 billion, so that in total, mining, smelting and refining together amounted directly for \$1.9 billion of production which was 5.3% of Gross National Product.

Exports of minerals in the form of ores, concentrates and primary manufacturers only, including aluminum, amounted to \$1.5 billion which was about 29% of total merchandise exports.

Direct employment in the mining, smelting and refining industries totalled 84,675, which was 1.3% of the labour force. However mining has a considerable multiplier effect on employment, considering suppliers and the service industries in those communities which depend on mining for their existence. As a rule of thumb, it is considered that the total number whose jobs are dependent on the industry is more than six times the number directly employed in mining. There is not much seasonal unemployment in mining.

Clearly the mining industry is of great importance to Canada, both in the aggregate figures and in its geographical distribution. Many areas of the country have significant population only because there are mines to support them.

The Business of Mining:

Considering the importance of the mining industry to Canada, it is surprising that to most laymen mining is a field shrouded in mystery. There is an awareness that mining is big and colourful, that it is difficult work, and there is a general belief that in mining a few lucky people strike it rich but that these few do not include most buyers of penny mining stocks. It is true that mining requires a collection of unique skills and it usually is carried out in remote areas. For someone who is interested in seeing industry at work it is much easier to get a visual impression of manufacturing which is carried on in or near cities, than it is to see mining. It may be helpful to give a brief description of the way mining is organized before examining the financial implications of this organization. The reader already familiar with the industry can omit the next several pages and proceed directly to Chapter 2.

The whole of mining can be divided into four parts - exploration, development, operation, and further processing which includes smelting, refining and fabricating. Although in practice one company can be involved simultaneously in two or more of these parts so that the dividing lines become obscure, these four categories provide a conceptual framework on which to arrange the detail of the industry. We shall examine briefly the workings of each phase.

Exploration:

The first prerequisite of mining is an orebody. Such a statement is trite but it involves more than is sometimes

appreciated outside the industry. An orebody has been described as a freak of nature, and in relation to the characteristics of most of the earth's crust an orebody is indeed a most unusual occurrence. Most deposits of metal bearing materials are not sufficiently large or of high enough grade to justify mining. While many such uneconomic deposits have been found, including some which are marginal at present, it cannot be said that the mining industry has anything approaching a general inventory of marginal deposits which could be developed if the price for the metal rose slightly or if the cost structure declined slightly. Thus the totals of new mining development do not respond quickly to moderate fluctuations in the general economy.

Exploration is the business of finding orebodies, and it involves many skills. In earlier days it depended on the prospector, a man having at least the rudiments of geology who could recognize metal or mineral bearing material when he saw it. The prospector is still an important man in the field although his relative position is diminishing. His search for orebodies literally cannot go deeper than the grass roots and most of the reasonably accessible orebodies which are visible from surface have been found. Today some prospectors work for exploration companies on salary with some form of incentive remuneration, the effect of which depends on what is found, while some prospectors work on grubstake. A grubstake is a simple form of syndicate in which a group of individuals or companies contribute a few hundred dollars each to provide the necessary supplies and equipment to support the prospector while he examines the area in which he is interested. There is a good deal of mobility of labour in prospecting. For instance a man

may work for a company for a season, then go out on grubstake, then return to the company.

The use of geophysical instruments has increased rapidly since World War II. These are instruments which detect changes, or "anomalies" in the earth's crust through measuring changes in the physical forces associated with the earth. These include changes in gravity, magnetism and electrical conductivity. Geophysical anomalies can be caused by many circumstances besides the presence of orebodies. So far however the only means, short of drilling, for obtaining an indication of whether there is an orebody hidden below the surface is through geophysical and geochemical techniques combined with geological appraisal of the area. Geophysical exploration is of course much more expensive than simple prospecting.

Geophysical techniques seldom penetrate more than 400 ft. below the surface. They are best adapted to finding large deposits, such as base metals or iron, and are not normally used in the search for precious metals which characteristically occur in deposits too small to be sensed by geophysical instruments.

Of rapidly increasing importance are geochemical techniques which involve analyzing soils and streambeds for traces of significant elements or compounds. Not only is geochemistry helpful in finding orebodies, but it also serves to eliminate large areas of search rapidly and relatively cheaply.

Surface prospecting, geophysics and geochemistry are often combined. A surface showing is often tested by geophysical and geochemical means to determine the possible size of the deposit.

Once a prospect has been found it usually must be tested by drilling. Holes are bored through the overburden and rock into the deposit, and the drill core is raised to the surface for examination. This is expensive but necessary to determine what lies underground. Drilling costs vary widely but in Canada they average perhaps \$5.00 a foot. The spacing of the drill holes varies with the circumstances - 50 ft. or less between the centres is usually considered close, while 100 ft. between the centres is common in drilling for base metals. In sedimentary deposits the holes may be more widely spaced.

Drill hole results require careful interpretation. For one thing the hole, once underground, usually does not continue in a straight line despite the best efforts of the drillers to keep it straight. Depending on the way the rock lies the hole may wander in any direction. In a normal vertical hole a variation of up to 100 ft. to one side in 1,000 ft. of depth is possible. Sometimes a hole will be led aside by a fault or a narrow stringer so that a drill will miss important geological information below the surface. If a group of drill holes all tend to converge below the surface they can present a misleading picture, particularly if they all pass through a small mass of mineralized material. Because the holes have converged it will appear that the mass of mineralized material is much larger than is in fact the case. Conversely if the drill holes all diverge they may miss entirely the top of an orebody.

Some definitions are required here. "Mineralized material" is rock which contains metals or minerals. "Ore" is mineralized material which can be mined economically. The determination of whether mineralized material is in fact ore

can obviously be a difficult problem, whose solution depends on the amount of mineral per ton of rock, known as "grade", the total tonnage of mineralized material available, and the percentage that can be recovered by concentration, the cost of mining the material and separating out the mineral, and the revenue which can be received from the mineral.

If drilling has indicated enough mineralized material to justify a mining operation, the material is known as "indicated ore". It usually cannot be considered "proven ore" until a shaft has been sunk and the orebody examined in detail from underground.

The organization of the exploration business is complex. Almost any imaginable variation can be found and it is not our purpose to examine all the examples. In general terms however exploration may be done either by individual prospectors or by exploration companies which vary widely in size. When a prospect is found it may be staked and tested thoroughly by that company. However if the company is not sufficiently hopeful of the chances of success, or is too small to afford the cost of testing, the prospect will normally be optioned to a company or a syndicate of companies for further testing. This option will normally provide that the optionee is to spend so much money in testing the property by certain dates, with the optionee being able to give up the property at any time if it so chooses. If the optionee decides the prospect is worth developing as a mine a new company is usually formed with the optionor receiving a stated number of shares for having provided the property and the optionee a stated number of shares in return for its expenses.

Sometimes a new company will be formed by a promoter before much work has been done on the property. Frequently the promoter obtains title to the property and sells it to the company in return for shares. The promoter then attempts to issue stock to the public to provide the cash for further testing of the property. His success in this will depend partly on his own skills and the mood of the market, and partly on the nature of the property and the amount of ore which has already been indicated on it. Most exploration companies get their start in this way, and find before their money is exhausted that the property is not worth developing as a mine. The remaining funds can be used in outside exploration including the optioning of other properties for testing.

Once a property has been sufficiently tested to prove up an orebody, it has reached the end of the exploration phase. The next step is to develop it as a mine.

Development:

Mine development is the capital consuming phase of mining. It involves large expenditures to sink shafts and prepare underground workings for mining, to supply the necessary surface facilities to separate metal or mineral from waste rock and usually to provide necessary accommodation and services for the men. One major facility which must be provided is transportation. If rail it is normally paid for by the railway against a long term contract for the shipping of product from the mine; if road the cost may be shared between the mine and the Dominion and Provincial governments. Power may be provided by the province or privately. Developing the mine requires a collection of engineering skills as well as careful business

management to avoid waste and to negotiate for transportation and power supplies. It is a hard game for amateurs, and this is one reason most mines are developed by companies which have already in being a staff of trained personnel. It is difficult, though not impossible, for a new company with no previous organization to develop a mine. So too the risk of serious overruns in cost and of poor efficiency in operation is smaller when the development is carried out by a well experienced staff.

When a company which owns an orebody is ready to have it developed as a mine it may employ the necessary engineers itself and attempt to raise funds, but more often it negotiates a deal with one or more established mining concerns. This deal may involve the organizing of another company to operate the mine, in which the vendor will have a certain share interest and the purchaser will obtain an interest through the purchase of shares for enough money to carry out the development. In almost every case the purchaser will obtain a majority of the stock.

Operation:

It is in the operation of the mine that the payoff comes for all that has gone into exploration and development. The operation of the mine may seem almost humdrum in comparison to the excitement of exploration and development and the financial dealing that accompany them. Normally all the outside capital is contributed in the development phase and that portion which is by debt is usually repaid as a first charge on earnings. After that the mine usually becomes cash rich and seldom requires

further funds. If it is decided to increase the production rate this can usually be financed out of retained earnings.

The comparative dignity that comes with the maturity of a mine in operation does not mean that there are no further problems. Fluctuation in the market prices of the products can have drastic effects on the profit. Enough ore is normally proven before the operation begins to assure the return of the investment, but the total profitability of the mine will depend on how much more ore is found. It is wasteful to prove up ore too far in advance of the time it will be mined since it might involve drilling through already proven ore or drilling long holes whose exact locations would be difficult to determine. Interest is lost on capital spent in development before it is required.

The normal mining risks are too often forgotten by the layman. A successful mining operation may deal with pressure problems, flows of water, heat, problems of ventilation, and incompetent ground (ground which tends to fragment). Sometimes the effects of one or more of these forces can be drastic and greatly increase the cost of mining or even force the mine to abandon operations.

Further Processing:

Ore can sometimes be shipped directly as it comes out of the ground but in most cases it must be concentrated by separating it from the waste rock. This process of milling or concentrating is usually considered a part of mining operation and done on the site. The further processing of ore beyond the concentrate stage includes smelting, refining and

fabricating. Smelting is a process by which, in the presence of great quantities of heat, the mineral is separated from the other elements with which it has been chemically combined. With Canadian base metals the other elements are often sulphur, iron and oxygen. The product of the smelter, while in a fairly pure state, contains other metals present as impurities. These can often be recovered through electrolytic refining. Both the smelter and the refinery require very substantial capital investments. The product of the refinery is metal in as pure a form as it is commercially practicable. For instance copper and nickel are produced to 99.96% purity, gold and silver to 99.99%.

In some cases, as in the new zinc plant being built by Canadian Electrolytic Zinc, the concentrate can be reduced directly to high purity metal through a process of electrolytic reduction without the separate stages of smelting and refining. The exact process used depends on which metals are included in the concentrate.

Because of the pressures of transportation cost the production of metal in its pure state tends to be located not too far from the mine, unless the concentrate can be carried by water. However transportation costs are not the only factor and sometimes concentrate is shipped considerable distances, for instance from Canadian mines into the U.S. or Japan.

The next stage beyond refining is fabricating, where the metal is worked into useful shapes such as wire, fittings, etc. Transportation costs sometimes encourage the shipping of metal in its purest state, for fabricating close to the ultimate

market, but here again other factors can intervene. For some metals there is little direct fabrication, the major uses being in combination with other substances. For instance much zinc is used as only one component of complex products such as paint and galvanized steel.

The economics of fabricating metals are mainly the economics of manufacturing, and can be quite different from the economics of other phases of the mining industry.

Chapter 2: The Future of Canadian Mining

The first question which presents itself in a consideration of mining finances is how much capital will be required in total for the mining industry in the next decade. For some industries a similar question can be answered through projection of effective demand for the products, then by applying certain ratios of capital to output, some estimate can be calculated of the amount of capital investment required to provide such a rate of production. This is not possible in this case.

In the mining industry most of the capital required is invested during the development of new mines and so the total capital requirement for the forthcoming decade will depend both on the number and the size of the new mines. However their number and size depends partly on the state of world demand for the products and partly on the results of exploration. Because the degree of success of exploration can in no way be predicted it is impossible to assess how much capital will be required in the mining industry. In economic terms mining development is a lumpy industry which shows only a loose correlation to general economic fluctuations.

However it is possible to analyze the prospective demand for the main categories of Canadian mine production in order to indicate the general environment in which Canadian mines will be developed.

The General Perspective:

Historic changes are under way which will shape the forthcoming decade into something appreciably different

from the past one. The years since World War II have seen reconstruction of war-torn lands; a major consumer goods boom on this continent based partly on consumption deferred in the war and depression years, partly on abundant supplies of money and near money, partly on technological advances from wartime and postwar research; a major armament program (including stockpiling of commodities) as the western world became aware of the concerted antagonism of communism; and a major capital goods boom to provide capacity to fill the demand for consumer goods and defence. In this favourable environment Canadian primary and secondary industry prospered sufficiently to carry a heavy burden of taxation. Government welfare programs expanded. Even though substantial immigration was attracted from Europe, unemployment was negligible and wage costs and consumer prices rose quickly. Although many causal factors were at work, these developments can be said to have been closely associated with the aftermath of war and the preceding depression and with cold war and Korean rearmament. The timing cannot be measured precisely, but in general terms the ending of the postwar boom in North America was signalled by the recession of 1957.

The past fifteen years have also seen another set of developments less intimately associated with war (although stimulated in part by pressures from the communist block) which could have greater significance for the future. The formation of the European Economic Community is creating a technologically skilled common market of 173 million persons, which compares with 186 million in the United States.

If the United Kingdom and other members of the European Free Trade Area ultimately join with the E.E.C., the resulting entity will have a population of 263 million.

The United States is attempting to greet this economic power with a program of mutual tariff reductions which will further enlarge effective world markets. The effect of such enlargement of the market for increasing efficiency and total production is fundamental. Europe has enjoyed a hectic capital goods boom in preparation for the growing effective market and, while the pace may slacken, further real growth is probable in this decade.

The growth of large scale research is also a fundamental factor. In the United States alone, expenditures for research and development are about \$17 billion annually, up from \$5.3 billion in 1953. In time, research will tend to increase consumption of base metals and iron, as well as bring to prominence metals not yet widely used.

In North America particularly some enlargement of the effective market is in prospect as those born in the postwar "baby boom" reach the labour force and begin to form families. Already the market for cars (initially for used cars) shows their effect. The impact of this growth in labour force on physical production will be significant, although partially offset by the trend to greater employment in service industries.

At the same time as these forces now tending to enlarge effective markets have been at work, the international political system has been drastically reshaped by the disintegration of colonial empires, except for those behind the Iron Curtain.

Since 1945, countries having an aggregate population of more than 900 millions have achieved independence. In the long run such transfer of power was probably inevitable, but an immediate effect has been to increase the political risks of investment in many of the former colonies and in the areas which are likely to become independent. Compared with the environment in Africa, Asia and South America, Canada's political stability is still an attraction to exploration and mine development, even though her favourable image has been somewhat tarnished in recent years.

The cumulative effect of all these developments is to promise substantial world consumption for the products of Canadian mining. Although the position of secondary manufacturing in this country with its small domestic market, high labour costs and high tax structure can fluctuate severely, the future of mining to provide the raw materials for growing production is encouraging.

However the many glamorous projects in Canadian mining in the past decade which were directly related to the cold war and rearmament will probably not be duplicated. The sudden development of the uranium industry under firm government purchase contracts, the stockpiling by the United States of base metals including some produced under incentive price arrangements, official pressure on the U.S. steel industry to expand capacity which helped stimulate the Canadian iron ore industry, all are unlikely to be repeated. On the contrary there is now a problem of top heavy stockpiles as the official expectation of length of an emergency (including any combination of limited and general war) has been reduced from five to

three years. There should be substantial international demand for Canadian mining products but without the startling increase of the past decade.

Iron Ore:

Iron ore has been the stirring and stretching giant of the mining industry during the past 15 years. A total of \$1,300 millions has been spent or is now committed, most of it to develop in remote locations great orebodies of several decades life expectancy.

However we must be prepared that the giant, having stretched, is unlikely to become much more active in this decade. Although the projects already under development, such as Wabush, will be carried through no large new commitments are likely to be undertaken. Both the European and North American steel industries foresee ample supplies of iron ore mainly on long term commitments, well into the 1970's and perhaps into the 1980's. On the basis of present obligations at least one large U.S. steel company expects to be a regular seller of iron ore in the spot market. Large iron ore developments require long term contracts for substantial portions of their output, and these are unlikely to be available. Mines which rely solely on the spot market face a difficult future unless they have very special advantages.

A further source of concern to the iron ore industry is the expressed intent of the Quebec government to assess mining tax on iron ore properties based on the Province's assessment of reasonable capacity. This tax would still apply even if

production is much less than the prescribed figure. The measure is aimed at stimulating production, in spite of abundant capacity.

Base Metals:

Base metals are sold in a variety of markets, ranging from almost perfect competition to monopolistic.

Producers merely of concentrate have a fairly simple sales structure. Normally they sign term contracts for several years with one or more custom smelters in Canada, the United States or overseas in Japan or Europe. Terms vary widely depending on competitive factors, but the net effect is that the mine's revenue fluctuates with market prices for refined metal. Probably fluctuations in revenue must be allowed for in financing base metal mines.

In selling finished metal, after it has been smelted and refined, the structure is more complex. The sales method for each metal, with its own problems and hazards, must be considered before financing a new project into production.

(a) Copper:

In copper new increments to Canadian production have been small compared with world consumption, and normally no Canadian new producer is large enough to affect world prices. Producers of copper concentrate have little trouble getting it smelted and refined on a custom basis.

In the past decade it has not been hard to sell copper in the form of finished metal. Auction markets exist, notably the London Metal Exchange which is used as a pricing guide in Europe. However most copper is actually sold on direct contract between refiner and fabricator. Established relationships can be quite strong, based on quality of the metal and reliability both of supply and of demand. In North America refiner-fabricator relationships are guaranteed to a considerable extent by vertical integration. While there is as yet little such vertical integration in the U.K. and Europe, the practice is beginning there and will probably increase. In the next decade, the position of the smelter or refiner who has no integrated fabricating outlets may become more difficult.

Considerable research has been undertaken by the industry to find additional uses for the metal, which it is hoped will be successful over a period of years. Considering this, an average price of 30¢/lb. appears reasonable (which is about the present level). Price elasticity of demand rises quickly at prices above 30¢ as aluminum is substituted for copper, but elasticity is small at prices below 30¢/lb. The industry has achieved considerable success in smoothing out the once notorious swings in price.

With copper averaging 30¢/lb., there are sure to be a number of copper mines developed in the next decade. Of course it is impossible to tell just how many new mines there will be, or their eventual production or capital cost, since this depends on exploration.

(b) Lead & Zinc:

The structure of lead and zinc markets is similar to copper, but there is considerable smelter-consumer integration in Europe and very little in North America. U.S. quotas are a serious handicap to new Canadian producers. Refined zinc metal is now produced by Consolidated Mining and Smelting and Hudson Bay Mining and Smelting. Consolidated at almost 200,000 tons per year ($5\frac{1}{2}\%$ of world production) is a significant factor in the world perspective. Canadian Electrolytic Zinc is now building a reduction plant at Valleyfield, Quebec to produce about 75,000 tons annually of zinc metal, which will be the first production of metal (as opposed to concentrates) in eastern Canada.

The price of zinc has been projected to average 14¢/lb. in the U.S., as compared with the present prices of 11½¢ U.S. and 8½¢ on the London Metal Exchange. (The difference between U.S. and L.M.E. is due mainly to U.S. quotas and tariffs). Zinc, like copper, is a latecomer to the field of competitive research, but considerable progress is being made in finding new and improved uses. The price recently has been especially depressed by Russian selling. Also the 1.4 million tons which have been declared surplus in the U.S. stockpile are disturbing to the market.

If the price of zinc averages well above the present, even if not as high as the projected U.S. price of 14¢, it should be sufficient to enable the development of new mines as they are found if they are rich enough to bear the

transportation costs. The huge Pine Point lead-zinc deposit will be brought into production by Cominco when the railway is completed in 1966. The initial plans are to use this only to replace exhausted sources of feed for the Trail smelter, so that it will not immediately increase supplies of finished metal. Planning is also under way to develop the large zinc-lead deposits in New Brunswick.

Lead has been a dull metal for many years and is likely to remain less attractive than most other base metals, even though its price projection at 14¢/lb. in the U.S. is considerably above the present prices of 10¢ U.S. and 6.2/3¢ L.M.E. In Canada lead is found only in association with silver and/or zinc, and the development of new mines depends on the market for all the joint products.

(c) Nickel:

Since International Nickel is capable of producing 80% of total free world supply of nickel, the structure of the industry is much different from that found with other base metals. Inco has long been known for its research and technical help to customers, and in substantial degree has created its own markets. Consumption of nickel fluctuates quite closely with steel production. The price is usually stable.

Nickel ores are rather difficult to smelt, and so the established companies have some advantage in know-how over a newcomer. The existing nickel mining companies are most aggressive in exploration for fresh sources. While

independent nickel mines may be developed it is more likely that new mines brought to production will be in the hands of existing companies.

Other Metals and Minerals:

There are of course numerous other metals which will be found and mined, which have a variety of prospects. Some like molybdenum seem to be on a good wicket. Others like lithium have passed through a brief whirl of glamour, only to be jilted by a fickle market. In this research age no one can tell which metals will become popular, nor which ones will be found in Canada.

The problems of uranium are well known. Even though breakthroughs in power generation are probable, and the industry is actively trying to develop new uses for uranium, no new uranium mines are likely to be brought into production in this decade.

Gold:

Gold mining faces an uncertain future. The growth of international trade and investment since the war and the growing strength of Europe have brought with them a serious problem of international liquidity. Per Jacobsson has given warning of the dangers of deflation. If ever mistrust of major currencies should become acute the enlarged production and trade anticipated for this decade would be seriously delayed. Of the many solutions put forward to this problem some involve raising the price of gold in order to increase

both the monetary value of existing gold reserves and production of new gold. Obviously such a change would have great impact on Canadian mining. On the other hand if the price of gold remains unchanged the importance of gold mining will continue to shrink as old mines become exhausted and few new ones are developed.

Silver:

Most silver in Canada is found as a byproduct to base metal deposits. A few small mines have silver as their main product, and large silver deposits are unlikely to be found. Although demand for industrial use and coinage is growing, the price is not likely to rise significantly above \$1.29 U.S. which is the price at which U.S. silver certificates would be demonetized, until the large U.S. reserves are dissipated.

Amounts Considered Surplus in U.S. Government Stockpile

<u>Commodity</u>	<u>Quantity (000 tons)</u>	<u>Value (\$000)</u>
Aluminium	729	\$349,844
Chromite .35 Grade	2,529	219,757
Cobalt (Content)	39	117,073
Copper	142	88,390
Lead	1,016	208,304
Molybdenum	13	35,428
Nickel (Content)	58	90,293
Tungsten	56	159,070
Zinc	1,402	336,388



28

160
140
120
100
80
70
60
50
40
30
20
10

D.B.S. Investors' Index
Base 1956=100

Price of Copper (E.&M.J.) N.Y.
¢ per lb.

300
200
100

D.B.S. Base Metals Index
Base 1935-39 = 100

1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961

Chapter 3: The Behaviour of Mining Stocks

As shown on the chart on page 28, metal prices, the D.B.S. Base Metals Index, and the D.B.S. Investor's Index of common stock prices generally all show some similiarity in their major fluctuations. However until 1961 the stock market as a whole had an upward trend not seen in the base metals.

As might be expected, when metal prices and base metal stocks are high and rising it is much easier to accomplish stock underwritings. In 1955 and 1956 cash received by mining companies through underwritings rose to very high levels which have not been approached since. Considering the ample supplies of base metals now available, including the top heavy stockpiles owned by the U.S. government, it is unlikely that the stock market will see any early renewal of the hectic action of the mid 50's, although there will be periods of greater activity than during the doldrums of 1960 and 1961.

Prices of Individual Mining Stocks:

The price of an individual mining stock will of course be sensitive to general conditions in the market but in addition it will show some curious fluctuations based on the company's own circumstances.

The market for an exploration stock is usually influenced by a promoter. If a property is being tested and the initial results are encouraging, rumours often leak out before any official announcement is made and the price can

move up smartly. If the results are encouraging the stock will tend to continue rising so long as the results continue to improve. That is, if a drill hole has better ore intersections than the previous hole the stock will usually move up; but a subsequent hole can have almost as good results and the stock will move down. This can be true regardless of the absolute level reached or the probable ultimate value of the orebody. The reason is that once the public has become excited about a property, it is gambling largely on selling the stock at a quick profit, and so the market becomes a kind of lottery on each hole. During the drilling program results which are only as good or poorer than previous results will often send the stock down, but if subsequently improved results are found the stock can swing up to new highs.

A great deal of attention is given to the question Is this deposit going to be a mine? But the curious reaction of the market is often that once it becomes clear that the property will be a mine the stock price declines. The reason is that the element of uncertainty has been reduced and therefore the incentive to gamble has also been reduced.

The range of fluctuations in exploration stocks tends to be greater for those companies which are heavily interested in promotional activities than for those which are more interested in mining. This is partly due to the activity of the promoter and partly to the activities of professional traders who expect greater excitement in the promotional stocks. Often when a prospect is first discovered the stock will move up very quickly and traders will sell short against it.

Usually the shorts will be right, but if a hot property really has been found the short interest will subsequently add fuel to the fire as the price rises. Traders tend to be more ready to speculate in stocks which are known to be promotional than they are in stocks which are known to be conservative in their attitude to the market.

Once it is apparent that the property will be put into production, and particularly if an announcement is made to that effect, activity in the stock will subside and the price will normally fall while some gamblers sell to people who are prepared to wait for production. As the mine comes close to production, usually two or three years later, the price can strengthen again but at a much more moderate pace. Only if it becomes evident that the mine is going to be a real bonanza is the price likely to rise above the previous highs of the exploration period.

Once in production, it is possible to calculate a reasonable present value for a mining stock based on projected metal prices, operating costs and ore reserves. However stocks of producing mines frequently sell higher than theoretical present value due to a complex of reasons. First of all ore reserves are seldom fully delineated before production begins, and there is an element of speculation in the possible extension of ore reserves. Also at certain times the market may be bullish about metal prices. However the chief factor seems to be a tendency of the investor erroneously to value mines actually in production on a basis roughly similar to manufacturing companies. It is illogical to value

a company which simply operates a mine and does little outside exploration on the same basis as you would value a manufacturing company, because the mining company is certain to run out of ore eventually while the manufacturing company is potentially immortal. A mining stock which is priced at ten times earnings and yields 7% may seem reasonably valued beside a manufacturing stock; but if it is going to run out of ore in six years it is obviously overpriced unless it has a sizeable investment portfolio and/or outside exploration program.

However it is important to distinguish between a mine operating company, and a mine development company which also operates mines. The mine operating company is doomed to eventual extinction but the mine development company can, by finding new orebodies to replace those becoming exhausted, continue and grow. In this respect the mine development company is similar to those manufacturing companies which are based on the continuous development of new products and sometimes sell at very high price earnings ratios. If a mining company has sufficient enterprise, capital and know-how so that it develops new orebodies faster than the old ones become exhausted, then its earnings and dividends per share can grow substantially over time and a valuation higher than the theoretical present value of its properties is justified.

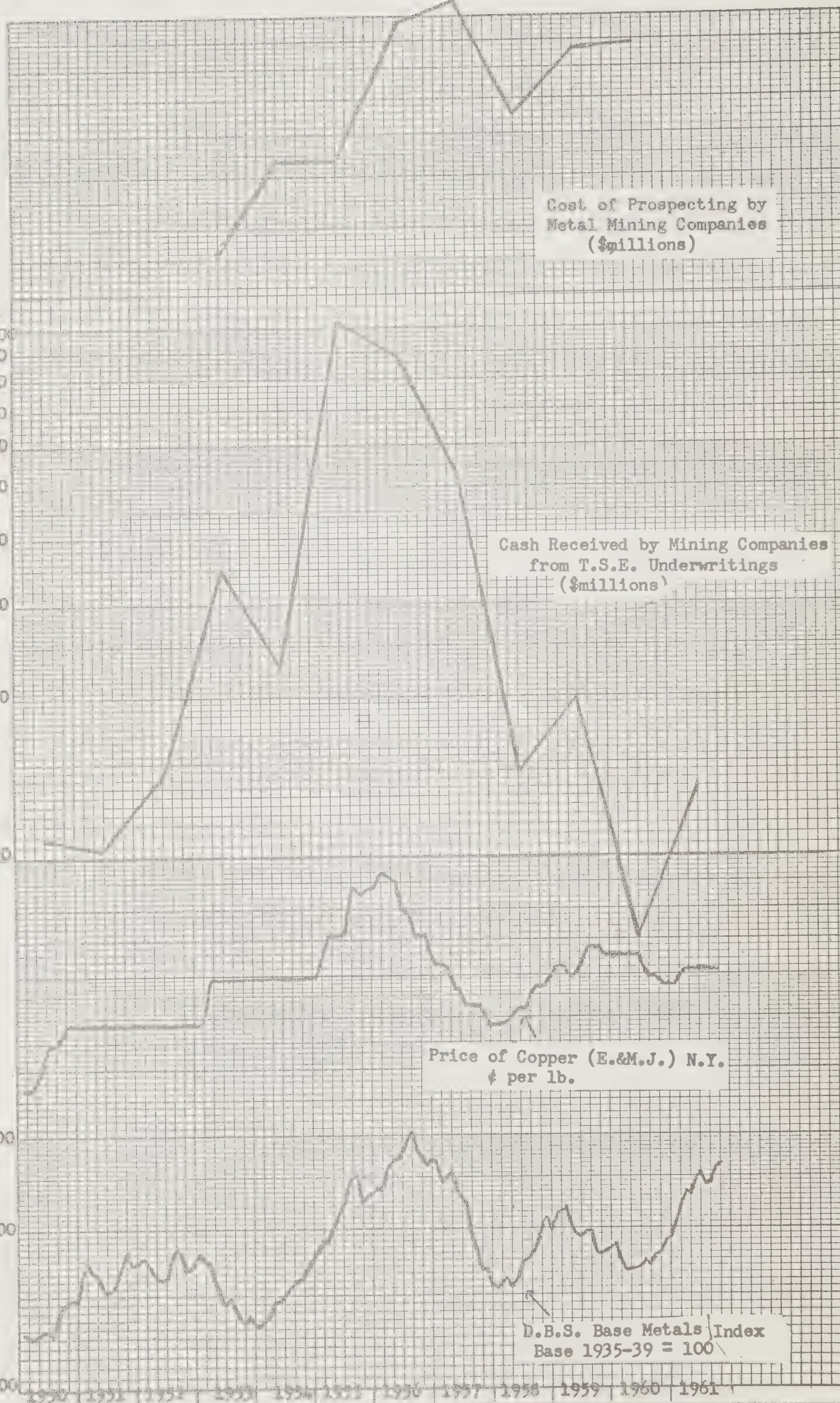
NORWOOD, MASSACHUSETTS
ANY, INC.

NO. 4235. POLYPURPOSE, 183 DIVISIONS BY 2 1/2-INCH CYCLES RATIO RULING.

NO. 4235. POLYPURPOSE, 183 DIVISIONS BY 2 1/2-INCH CYCLES RATIO RULING.

50
45
40
35
30
25
20
15Cost of Prospecting by
Metal Mining Companies
(\$millions)100
90
80
70
60
50
40
30
20
10Cash Received by Mining Companies
from T.S.E. Underwritings
(\$millions)50
45
40
35
30
25
20
15
10Price of Copper (E.&M.J.) N.Y.
¢ per lb.300
200
100
0D.B.S. Base Metals Index
Base 1935-39 = 100

1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961



Chapter 4: Expenditures for Mining Exploration

The total amounts spent on exploration in Canada have increased substantially since 1953, as shown by the following table:

	<u>Cost of Prospecting by Metal Mining Companies (\$000's)</u>	<u>Diamond Drilling for Exploration & Testing (000's of feet drilled)</u>
1953	\$17,833	4,016
1954	26,815	4,807
1955	26,929	6,698
1956	48,400	7,088
1957	54,424	5,332
1958	32,507	4,788
1959	43,580 *	5,405
1960	44,345 *	

* Includes asbestos mining companies,
1959 - 562; 1960 - 791

Source:- D.B.S.

(Figures for Cost of Prospecting are shown
in chart form on Page 34)

The rising trend of exploration expenditures reflects in part the higher cost of more sophisticated geophysical techniques, more diamond drilling through overburden and overlying barren rock, and increased transportation costs as the search penetrates more remote areas.

It also reflects greater interest in finding new mines in Canada, by both domestic and foreign companies.

As can be inferred from the chart on page 34, fluctuations in exploration expenditures from year to year appear to depend mainly on fluctuations in price of the established metals, together with the amount of interest in new metals such as uranium. Monetary policy has little direct impact on prospecting, except that its impact on the whole stock market affects the ease of stock underwriting, which can affect exploration expenditures that year or next.

The Roles of Large and Small Companies in Exploration:

Exploration is the most colourful phase of mining. The hunt for the lucky strike has called forth an unusual breed of men, no less skillful for their colour. It has also attracted the largest number of independent groups, small companies and syndicates that organize and reorganize, trying this chance and that. And the financial side of exploration is equally colourful. The financing of these new ventures and the after-market may have faults, but it never lacks for colour.

But in spite of the attention given to the small exploration groups and the related stock markets, the bulk of exploration is done by larger companies - companies with producing mines or treasuries left from now exhausted mines, or foreign companies some of whom are quite active in Canada. As shown in Table A, fully half of prospecting expenditures in 1960 were made by 13 companies each spending over \$500,000. A total of 86% were made by firms spending at least \$100,000 together with those spending over \$10,000 which already had producing mines. Of course a wealthy company may have spent less than \$100,000, or a small exploration company may have "shot the works" to spend over \$100,000. If an exceptionally promising prospect has been discovered it is not too hard to raise several hundred thousand dollars from the public to test it, and such a prospect will usually have quite a good chance of becoming a mine. But in general terms it appears that most of the \$43,554,000 spent on exploration was undertaken by companies of appreciable financial strength.

Table A:

Cost of Prospecting conducted by Metal Mining Companies, 1960

No. of Firms		Size of Expenditure	Aggregate Expenditure (\$'000's)		
13	3%	\$500,000 and over	\$21,769	50%) 86%
70	16%	\$100,000 to \$500,000	14,976	34%	
29 with producing mines	7%	\$10,000 to \$100,000	840	2%	
151 without producing mines	34%	\$10,000 to \$100,000	5,283	12%	
176	40%	\$1,000 to \$10,000	686	2%	
439	100%		\$43,554	100%	

The reasons for the dominant position of large companies in exploration are easy to see. A profit making company deducts exploration expenses from taxable income which a junior exploration company with little taxable income cannot do. Also each particular dollar spent on exploration is very likely to be lost with no return except the negative contribution to human knowledge that a hoped-for orebody is not to be found in this or that particular location. The chance of an average prospect becoming a profitable mine is one in a few thousand: one estimate is one in three thousand. It has been estimated that in recent years there has been an expenditure in exploration of \$25 million per new mine developed.

Ontario 1907-1953

419,711 claims recorded
 6,679 companies formed-
 (metal mining only)
 348 producing mines
 54 paid dividends (i.e.
 presumably were
 economically successful)

Quebec 1907-1942

36,202 mining licenses
 246 mining concessions
 87 producing mines
 31 paid taxes
 9 paid dividends

Source: Ontario Mining Association

If a company is large enough to carry a substantial exploration program over several years conducted by competent engineers, if it is big enough to make the law of averages work for it, then in total the money may prove to have been well spent by the discovery of enough new mines to make its total exploration expenditure appear economic. But if the company can afford only a few bets, it is almost surely doomed to failure. Then too the larger companies usually have organizations ready to develop a new property once found, which give them an advantage over the small company which must usually deal off a new property for development by another organization with experience.

Very probably exploration will continue to be dominated by the larger companies. No breakdown of exploration expenditure by size is available for prior years, but the trend can be inferred from the chart comparing Cost of Prospecting with Cash Receiving by Mining Companies from Toronto Stock Exchange Underwritings (page 34). While prospecting expenditures after a substantial increase between 1953 and 1957 have fallen back only slightly, cash received through underwritings has dropped to only 13% of the 1955 peak. Great activity by the small companies in 1955 and 1956 was associated with the very high metal prices and excited stock market. Runaway metal and stock prices are not likely in the forthcoming decade, and without them there can be no rash of new small companies.

This is not to say that the small exploration company will or should disappear. So long as small companies and promoters find promising prospects they will have opportunities to fill their treasuries, and the funds not required to test

the prospect for which they were raised will be available for further outside exploration. The greater the number of exploration groups which are active, the greater the diversity of geologic thought which will be brought to bear and the greater the chance of finding orebodies. The importance of a variety of interpretations of geology is illustrated by the fact that several properties which had been rejected by a number of companies were subsequently developed as profitable mines. Certainly the junior exploration companies do find mines.

Dealing for Prospects:

Among the larger companies there are differing opinions as to the most advantageous side of exploration. All of them will deal for other people's properties, and most of them maintain at least a few grubstakes or prospectors on payroll. The prospector normally has some participation in a new property which he finds, a form of incentive. A sample form of contract is shown in Appendix 11(a). Probably the most economic use of funds however is in the examination of likely-looking prospects brought in, and good field men are essential for this.

If the company which employs the prospector chooses to test the property fully, and has the funds, it does so. However the prospect is often held by an individual, company or syndicate which is not able or does not choose to spend the money. In this case the owner will try to make a deal for someone else to do the work of testing the property.

The form of deal which is made for a new prospect is subject to infinite variation depending on the nature of the property and the attitudes of the principals. We shall at least try to examine some common arrangements since the process of dealing in effect sets a price on the prospect, and price is important to the business of financing.

Usually an option is taken under which the optionee spends prescribed sums of money on further testing of the property, with the right to drop the option if results are unfavourable or to continue through to develop it as a mine. Often there is a cash payment. Usually the agreement provides that before mine development begins a new company will be formed in which the optionor (up until then the owner of the property) will receive a stated number of shares, the rest going to the optionee as money is spent. The portion of the stock which goes to the optionor is known as the vendor's interest. A sample form of option agreement for use with a raw prospect is shown in Appendix II(b). Obviously the more ore indicated on a property before the option agreement is made, the better the optionor's bargaining position.

Sometimes a promoter will acquire a prospect in his own name, through purchase from a prospector, and sell it to a company which he controls - it may be an existing company or a new one which he incorporates for the purpose. He causes the company to issue him shares for the claims. Because of the possibilities for unethical practices inherent in such a transaction, the Ontario Securities Commission has ruled that companies under its jurisdiction which are in primary dis-

tribution may not issue for a property more than 25% of the total authorized capital.

This 25% for the vendor's interest is something of a reference point in negotiations. When dealing with a promoter the vendor's interest will often be the full 25% of authorized capital, particularly if the promoter owns the claims involved. Deals with large mining companies are seldom for as much as 25% since the vendor is assured that ample funds and technical skill will be available to develop the property efficiently. Sometimes a property passes through a number of deals before being brought to production as a producing mine, each optionee retaining an interest along the way.

Chapter 11. Financing the Junior Exploration Companies

Those groups interested in exploration which are not backed up by a producing mine or a large fund of capital must turn to the equity market for funds. Debt financing is not appropriate because of the risky nature of the business, although sometimes bank loans are obtained against collateral such as the shares of a previous successful venture.

It is in this area of financing exploration companies through primary distribution of stock, together with the resulting secondary market, that the public becomes most directly involved in exploration. Here are the hope of greatest gain and the greatest likelihood of loss. Here are the most rumours and the greatest scope for shady practices. Here the official regulatory bodies concentrate most of their

Many junior exploration companies get their start when a promoter puts a prospect into a company and issues stock to the public. The financing may be accomplished by a broker-dealer who undertakes to buy (say) 100,000 shares @ 10¢ with options for equal numbers of shares @ 20¢, 30¢, and 50¢. The underwriter makes a market in the stock and attempts to distribute it to the public. This is usually an expensive method of raising funds. The cost of salesmen, printing, telephone and underwriter's profit are usually substantially greater than the amount which is added to the company's treasury. It has been estimated that of the total funds received by the broker-dealer in primary distribution, on an average perhaps 60% goes to distribution costs and profit and only 40% to the corporate treasuries.

A stock exchange listing is a highly prized asset, for

it greatly facilitates the primary distribution of shares.

If the prospect which originally justifies the listing fails to be an orebody the listing normally continues, and so it can be used in connection with subsequent finds.

The cost of raising capital for a listed company is less than for an unlisted one, but it is still substantial. The net profit to the underwriter can be greater because of the wider scope of the operation.

The techniques by which promoters sell stock and the peculiarities and dangers present in primary distribution form an important discussion in themselves, but since they are being covered separately in studies of security markets and security regulation they will not be examined here. We will however set the scale of the problem and the significance of primary distribution to the mining industry.

Amounts raised by underwriting have been as follows:

Cash Received by Mining Companies for Treasury Stock Issued through Underwritings and Options

	No. of T.S.E. * <u>Underwritings</u>	Companies Listed on Toronto <u>Stock Exchange</u> (\$000)	Companies Financed through <u>Broker-Dealers</u> (\$000)
1946		\$ 17,513	
1947		14,231	
1948		6,496	
1949		9,492	
1950		10,741	
1951		10,245	\$ 13,331
1952	96	14,408	12,453
1953	142	35,002	9,891
1954	133	22,714	14,074
1955	217	102,357	17,144
1956	179	84,190	25,162
1957	126	53,060	9,110
1958	95	14,393	15,452
1959	94	19,765	19,578
1960	58	7,109	15,180
1961	71	13,659	9,566
1962 to July		11,862	n.a.
31		<u>\$447,244</u>	<u>\$160,940</u>

* Includes repeated underwritings by the same companies.

Total number of companies involved from 1952-1961 was 352.

Sources: The Toronto Stock Exchange.

The Broker-Dealers' Association of Ontario.

The Use of Funds Raised from the Public for Mining Exploration

Analyses of the total of funds raised from the public for mining companies, through underwritings and options, and a comparison with the totals of exploration expenditures as compiled by the Dominion Bureau of Statistics (page 45), shows a startling discrepancy.

The total cash received by listed mining companies (mostly exploration companies) through underwritings and options on the Toronto Stock Exchange was \$338 million for the eight years 1953-1960. From this total an amount of \$92 million can be subtracted as having been raised for purposes other than exploration (primarily capital used for putting mines into production), leaving a net of \$246 million raised for the general purpose of exploration. In addition, the Broker-Dealers' Association has reported annual totals of funds raised, and it is estimated that 75% of these, which is \$94 million, could be attributable to mining. Thus the total sum raised from the public for mining exploration in the period 1953-1960 appears to have been about \$340 million.

The D.B.S. reports that the total cost of prospecting by metal mining companies in the same period was \$295 million, but this D.B.S. figure includes all the prospecting done by large companies which finance exploration out of their own retained earnings. Even allowing for the greater activity of the junior companies during the days of high metal prices, it is reasonable to allow that at least half the total cost of prospecting was attributable to the senior companies which do not raise exploration funds from the public. In other words

Funds Raised from the Public for Mining Companies (including Exploration)

	<u>Col. 1</u>	<u>Col. 2</u>	<u>Col. 3</u>	<u>Col. 4</u>	<u>Col. 5</u>	<u>Col. 6</u>
	Total Cash Raised by Mining Companies Through Underwriting & Options on T. S. E.	Non-Exploration Money Raised	Net Raised for Exploration (Col. 2-Col. 1)	Raised Through Broker-Dealers, minus 25% attributed to Oil	Raised for Mining Exploration through markets (Col. 3+Col. 4)	D. B. S. Cost of Prospecting
1953	35,003	4,567	30,436	7,418	37,854	17,833
4	22,714	7,706	15,008	10,556	25,564	26,815
5	102,357	23,805	78,552	12,858	91,410	26,929
6	84,191	34,137	50,054	18,872	68,926	48,400
7	53,061	8,005	45,056	6,833	51,889	54,424
8	14,393	1,948	12,445	11,589	24,034	32,507
9	19,765	7,501	12,264	14,683	26,947	*43,580
1960	7,109	4,195	2,914	11,385	14,299	*44,345
<u>TOTAL</u> <u>(1953-</u> <u>1960)</u>	<u>338,593</u>	<u>91,864</u>	<u>246,729</u>	<u>94,194</u>	<u>340,923</u>	<u>294,833</u>

* Includes asbestos mining companies: 1959 = 562; 1960 = 791

no more than about \$150 million apparently was spent for exploration by the junior companies which raised funds from the public, even though \$340 million was raised for the purpose of exploration.

Of course the figures are somewhat arbitrary in some places. They are not strong enough to be conclusive, but rather are intended to be illustrative. The figures for cash raised are from an actual count by The Toronto Stock Exchange and The Broker-Dealers' Association. For the cost of prospecting, the D.B.S. makes every effort to obtain a full count of expenditures, but their survey may not be complete. The D.B.S. figures are intended to include the cost of properties purchased, but in fact the D.B.S. has to rely on the information returned on the questionnaires which may not be entirely accurate or complete.

Nevertheless the magnitude of the discrepancy is too great to be brushed aside merely because of possible weakness in the figures. Part of the discrepancy may be accounted for by the necessary overhead of the exploration companies. Another part may be found in investments outside of prospecting, such as real estate, which may have been undertaken if the original property for which the funds were raised was proved uneconomic. Some may still be resting in corporate treasuries. However the discrepancy is large enough to cause concern whether a significant portion of these funds might have been diverted to the benefit of promoters and other insiders rather than to the benefit of the shareholders. Only a series of detailed audits, following through on the use

made of funds raised from the public, would provide definite answers, and this is beyond the scope of this study. However the sum involved suggests that regulatory agencies should conduct a much closer inspection of the affairs of these junior companies after funds have been raised and not just during primary distribution.

Financial Operations After Funds have been Raised from the Public:

An exploration company is frequently controlled by an individual or small group which either includes an underwriter or which has strong underwriting connections. It is not necessary for this group to own very much of the stock in order to have effective control of the company - 10% to 20% is usually enough. Not only is there the benefit of the management proxy, but in addition much of the stock purchased by the public is kept registered in the underwriter's name. Why should a small shareholder bother to have his stock re-registered into his own name when no dividend is being paid? The shares are left in street form and the underwriter votes all the stock registered in his name.

Since control can be maintained in this manner at comparatively little cost, the promoter has considerable flexibility if he chooses to operate in the market for his own profit. When a new property is examined he can determine what information is made public, is in the best position to appraise that information, and can acquire stock before the information is released. If he owns the property he can receive up to 25% of the stock in exchange for it. Subsequently he can sell stock when the market is high (except for

escrowed stock). The possibilities for the deliberate use of rumour and innuendo are obvious. The extent to which a promoter practices these arts is a matter for himself and his conscience, but some promoters fare better than the outside shareholders of the company.

As previously indicated, the chance of a prospect becoming a dividend paying mine is small, but the public is often willing to pay highly for the chance until it is disproven.

Aside from considerations of personal gain, the promoter has an interest in having his stock sell as high as possible. Those who bought the shares in primary distribution will think well of him when the market rises, even if they themselves fail to sell at the high prices and see their stock fall again. If the company is running short of funds it can issue enough shares while the price is high to keep it in operation for some time to come. There is a tricky problem of ethics here as to the nature, timing and interpretation of news, complicated by the fact that promoters are usually genuine optimists whose appraisal of a situation is coloured more by possibilities than by probabilities.

The excesses of insiders in the mining market are many and varied. Generally speaking a layman is much more likely to lose than to gain by buying speculative shares unless he really is close to the situation - not just thinks he is. At the same time any prospect has a chance, however small, of becoming a wealthy mine and this chance has an economic value.

It is not the purpose of this study to examine

extensively the subject of securities regulation. However in this area of questionable practices among listed stocks, and unlisted stocks for which a working market has been established, the public is entitled to a fuller measure of protection. Since the field of share pricing is so open to personal judgment and appraisal of risk, it is most difficult to police by explicit rule and regulation. The remedy would appear to lie therefore in fuller disclosure of their market operations by promoters. The Dominion Companies Act already has a provision concerning trading by directors:

"98.

(1) Every director of a public company shall furnish annually to the secretary, for the information of the shareholders of the company at the annual general meeting thereof, a statement setting forth in detail all shares of other securities of the company bought or sold by him, for his personal account, directly or indirectly, during the twelve months immediately preceeding such annual meeting.

"(2) No director of a public company shall speculate, for his personal account, directly or indirectly, in the shares or other securities of the company of which he is a director.

"(3) Every director of a public company who neglects or fails to make a true and accurate statement of such transactions as required by subsection (1), is guilty of an offence and liable on summary conviction to a fine not exceeding one thousand dollars or to six months imprisonment or to both fine and imprisonment.

"(4) Every director of a public company who speculates, for his personal account, directly or indirectly, in the shares or other securities of the company of which he is a director in contravention of subsection (2), is guilty of an offence and liable on summary conviction to a fine not exceeding one thousand dollars or to six months imprisonment or to both fine and imprisonment".

These provisions are seldom enforced in practice. The information is given to shareholders only on request, and it is rare for a shareholder to request it, partly because those members of the financial community who best know when the question should be asked are frequently unwilling to antagonize the directors.

A considerable improvement in the ethics of promoters and other insiders could be expected if all directors were required to report in detail their purchases and sales of their company's stock, by themselves or their families or in which they are beneficially interested, showing dates and amounts. These reports would be submitted to the company's secretary quarterly and distributed by him within 30 days of the end of the quarter to all shareholders who have requested it, to the provincial securities commission, and if a listed company to the stock exchange for redistribution to members, or if unlisted to the Broker-Dealers' Association for redistribution to members. To be effective, reporting should be detailed and prompt. A stiff penalty should be provided for failure to report accurately and in full.

The purpose of such a provision would be to illuminate the extent to which a director was profiting by his inside position. If an unscrupulous insider talks bullishly, while selling his own stock, this will become apparent soon enough for the misled speculator to identify the timing. An insider who deserves a bad reputation would soon achieve it.

It may be argued that such a rule could be easily broken. This is probably true, but a penalty of \$1,000 or 6 months or both should command some respect. Furthermore it would give the securities law enforcement officers a basis on which to act. An insider might easily break this law, but if caught he would be finished in the financial business. In drafting legislation, account would have to be taken of the fact that a promoter need not himself be a director but might work through nominees on the board.

Future of the Junior Exploration Companies:

On our assumption that the dramatic upswings in metal prices are not likely to be repeated in the next few years, it is likely that the relative importance of junior exploration companies will continue to diminish. On the one hand funds will not be easy to raise from the public (though this will fluctuate with the business cycle) and on the other hand exploration is becoming steadily more sophisticated and more expensive.

In the United States similar trends, together with S.E.C. regulations, have led virtually to the disappearance of the publically financed junior exploration company, with some

exceptions such as the rash of uranium companies a few years ago. It may be asked Will publically financed junior exploration companies become extinct in Canada?

The answer to this question seems to be Not in this generation.

In Canada there is still a great deal of virgin country. As new mines and town-sites are developed in the wilderness they become focii of exploration activity. So long as there is a place for the grass roots prospector and the cheaper kinds of geophysical and geochemical testing, there will be a place for the publicly financed junior exploration company.

On the other hand it is clear that the trend is towards exploration by the large companies who finance themselves through retained earnings. While it is fitting that the small company should be able to raise funds from the public, it is also fitting that government should adopt wise rules to ensure full and honest disclosure to the public who are being asked to supply funds. Government need not worry that by enforcing a high standard on the markets which deal in primary distribution it is liable to retard seriously the economic development of the country. The junior company can fill a useful role, but the public is entitled to a full measure of protection against dishonest practices.

An obvious question at this point is to enquire whether actual expenditures on exploration by junior companies are more or less effective per dollar spent than expenditures by major companies. No definitive analysis is possible, but

certainly junior companies have had a hand in the finding of several mines. Junior companies sometimes are willing to spend money on quite marginal situations. Major companies sometimes embark on very expensive programs using very sophisticated equipment, but without success. The feeling in the industry is that on balance a dollar actually spent on exploration is probably spent equally well by either a major or a junior company.

Chapter 6: Financing of Mine Development

The business of developing new mines is hard to enter. Finding a substantial tonnage of ore is but the first step on a difficult road, and it is a rare newcomer who treads his way down it to the goal of full production without hitching a ride from an established mining company or consumer of the product, or from government.

The reasons for this are easy to see. Developing a new mine usually takes a great deal of capital and a variety of engineering and possibly marketing skills. Most of the capital must be spent before production begins, and once committed cannot be retrieved or put to alternative use; for much of the money is spent on holes in the ground which are useless if the supposed orebody proves uneconomic, and the rest is spent on machinery and buildings which (considering transportation cost) are usually worth little for salvage. Capital cost estimates can be wide of the mark because of the unique aspects of each mine.

The method of financing depends on ownership and the nature and degree of risk. Risk in turn is determined by the size, grade, reliability, projected operating cost, and cost of development of the orebody together with the sales method and price structure. Many minerals sell in a world market in conditions approaching perfect competition, and except for nickel the Canadian miner seldom has much control over the price of his product. If his view of prices has been overly optimistic he will not receive the expected return on his investment, and he may lose his capital.

The degree of risk, otherwise appalling, can be lowered by a team of competent engineers. An experienced geologist, practicing his art as well as science, can form a reliable judgment of whether an orebody is hidden in the rock. When an orebody is exposed by underground development it rarely is quite as it appeared to be from diamond drilling, but a good geologist should gain as much as he loses from his original estimates. Much depends on selecting the right mining method for extracting the ore, which depends on the lay of the ore and the competence of the ground, i.e. the ability of the surrounding barren rock to withstand crumbling. Problems of separating minerals from waste rock, and often from one another, have delayed or prevented the development of many deposits.

Obviously an established mining organization, having a skilled and trusted staff of engineers and the capital to back them up, has a substantial advantage over the neophyte in mine development.

Once a mine is in operation it can usually finance expansion (if any) out of retained cash flow. Sometimes it issues bonds or obtains bank credit for development of new properties using the existing operation as collateral. The neophyte, if it reaches the maturity of established production, can become a mining development company in its own right.

A sponsoring company which sets out to develop a wholly owned orebody will usually provide funds out of its

own liquid resources and if necessary its borrowing power. Such borrowing can be from banks or the public, and it is usually based on the credit of the whole sponsoring company. If the sponsor has a first class credit rating, financial institutions such as insurance companies will buy its bonds readily, but it is not usual for such institutions to invest directly in new mines.

Often a new company is formed to develop a new mine. If there is a substantial public interest in the company, even though effective or formal control lies with a sponsor, maximum possible use will be made of debt to minimize dilution of equity. But the sponsor will be entitled to a share bonus for any special financing facilities it provides.

The best circumstance for debt financing is a firm purchase contract for the output by a well-regarded customer which either explicitly guarantees the debt or clearly provides sufficient revenue for complete debt retirement. The uranium industry was financed 88% by debt on the strength of firm government contracts, but such an experience is not likely to be repeated in the near future since no government is likely to sponsor such a crash program. Moreover some of the uranium mines experienced severe difficulties, and with this experience in recent memory investors will be more cautious in buying bonds of heavily leveraged mining companies.

Capital Expenditures in Mining:

A compilation has been made of the capital cost of new mines and major additions to plant, which shows expenditures since 1950 of:

	(<u>\$ millions</u>)
Iron Ore	\$ 954
Base Metals (excluding aluminum)	997
Uranium	455
	<hr/> \$2,406 <hr/>

Between the groups there is considerable variation in the manner of financing, but one principle is common to all three: in most cases the new development was undertaken with substantial outside support from government, a consumer of the product, or a well established mine development company. Only a few smaller mines were able to reach production without a sponsor.

Iron Ore:

In the Quebec-Labrador trough, north of Seven Islands, there have been three giant iron ore developments at a total cost of \$690 million, beginning with the Iron Ore Company of Canada near Schefferville which reached production in 1952. Almost all of the capital was provided through steel companies in the United States by deficiency guarantees for loans. A fourth, Wabush Mines, is under development, in which two Canadian steel companies will

participate. It is expected that both Stelco and Dofasco will provide their portion of the \$230 million capital cost out of their own general corporate funds. In addition a \$60 million pellet plant is being built, associated with Iron Ore Company.

It is curious that the largest developments in Canadian mining should be carried out with so little use of Canadian capital, but this is an effect of the sales method. The projects could not have been undertaken by anyone without firm commitments by large steel mills to buy the product, and most steel mills prefer to own an interest in the mines to which they give large, long term contracts.

There have also been several smaller iron ore developments, chiefly in central Canada and British Columbia. Those in central Canada also have been closely associated with steel companies. The only one with a direct public interest is Steep Rock Iron Mines which came to production in 1944, although it has expanded capacity since 1950. Borrowings since then have been in U.S. funds, in part against future royalty income. The mines in British Columbia are all comparatively small and ship concentrate to Japan. None have any direct public participation, but two are subsidiaries of Canadian companies.

Base Metals:

A list of base metal mining developments completed between 1950 and 1961 shows a total capital expenditure of

\$997 million. This total is substantially in excess of the total of capital expenditures shown by the Department of Trade and Commerce in its annual survey of private and public investment in Canada. The reason is that the Trade and Commerce figures do not include as business investment the costs of housing and community development, and sometimes transportation, which must be borne by the mining companies.

Since no routine record is kept of the capital cost of new mines, it is possible that our special compilation has overlooked a few small developments, particularly those which were short lived, but it is felt that the picture presented is substantially correct.

The most striking fact to emerge is that very few of these developments were brought to production as completely independent companies without the sponsorship of either existing mining companies or customers. It is estimated that the total capital cost of ten mines which were developed without any sponsorship was about \$50 million. As was observed earlier, it is not impossible for a mine to bring itself to production without outside help, but it is very difficult.

In the early 1950's considerable help came from the U.S. government, who were anxious to increase the supply of base metals for defence purposes. Special price arrangements were made and financing provided in order to stimulate production. In addition purchases were made on the open

market which, added to civilian requirements and a booming economy, drove up the prices of base metals. In 1955 and 1956 copper rose from 30¢ to over 46¢ per lb. in New York (custom smelter prices went even higher). These high prices stimulated the development of new mines including some which were not viable under more normal conditions of price.

Except for the U.S. government, no other customer of the base metal mining industry is known to have advanced funds to develop mines purely to assure a source of supply, except for the Japanese who helped to finance Cowichan Copper and are now helping to finance Bethlehem Copper, both in British Columbia. However in a few cases working capital has been supplied by advances against concentrates produced. Nevertheless these practices could become more common in the future.

Much the greatest part of the funds supplied came from the retained earnings of established mining companies acting as sponsors. It appears that over 75% came from this source. In other cases bank loans have been taken and bonds and shares sold to financial institutions and the public. The exact terms have varied but where outside financing was undertaken the presence of a sponsoring company has usually provided an umbrella.

Uranium:

The development of the uranium industry was most unusual in many aspects. Its rocketing growth was

entirely due to the free world's apparently urgent need of uranium for defence, which motivated the giving of special contracts by the government to companies having indicated orebodies. For security reasons certain information was withheld, and in a general way it was assumed by the investing public that the success of the ventures was virtually government guaranteed. Secrecy augmented the aura of mystery and excitement surrounding uranium, so that uranium issues appeared very glamorous. In such circumstances the industry was financed very quickly mostly from the public, sometimes before adequate geological information was available. Of the total capital expenditures amounting to \$450 million, an amazing 88% was raised through bonds and bank loans. Much of this was repaid without difficulty. But in a few cases the mines experienced high costs and shortage of ore, and only the permission of the government to transfer contracts (for uranium no longer needed) enabled the bondholders to be bailed out.

It is most unlikely that the peculiar circumstances surrounding the uranium industry will be repeated in the forthcoming decade. In considering statistics of mining in Canada since 1954 it is necessary to remember the impact of uranium and to allow for it when considering the possibilities for Canadian mining in the future.

Sensitivity of Capital Expenditures in Mining to Monetary Policy:

It is apparent that Canadian credit conditions can have little effect on capital expenditures if the expenditures are not financed with Canadian credit.

While the iron ore industry has borrowed for investment, the money has come largely from the United States and so not been directly subject to Canadian monetary policy. It seems probable that in future mining developments which are able to use extensive debt financing because of the presence of adequate sales contracts will be closely associated with the foreign customer, and so will not be directly influenced by Canadian monetary policy.

However the foreign exchange rate could be an important factor. The decision to develop a property will only be taken if there is in view a satisfactory average rate of exchange for Canadian currency. If an imminent change in the rate is foreseen, movement of funds into Canada could be retarded or accelerated. If accelerated, the capital expenditure would probably not be speeded up, since the construction schedule is usually as rapid as possible. If movement of funds into Canada were retarded, the entrepreneurs would try to keep the project on schedule through temporary bank borrowings. Only if a significant fall in the Canadian dollar were likely, and no Canadian bank accommodation were available, would the project be delayed. These two conditions are not likely to occur together.

In the case of mines which are developed largely with the retained earnings of other mining companies, credit conditions usually play little part. The reserve funds are usually kept in reasonably liquid form, and any loss incurred by selling short term bonds is considered inconsequential when there is a new mine to develop.

However bank borrowings are used for working capital, both during construction when major financing has been arranged but not yet completed, and in the first days of production. It often is three or four months after shipments begin before the first revenue is received in cash, and a new mine frequently uses bank borrowings to pay its costs during that period.

For monetary policy to affect the timing of capital expenditures in mining, credit would have to be so tight that bank accommodation would not be available for these working capital purposes.

The state of the bond market can affect those projects which are to be financed through sale of bonds to the public or to financial institutions. But as has been indicated, these comprise only a small portion of the industry.

There seems however to be some tendency for the mining industry to look increasingly to bank financing in developing mines, at least in certain cases. If this trend continues mining development could become slightly more responsive to monetary policy.

Chapter 7: Sources of CapitalEquity Capital:

A great deal of capital has been invested in Canadian mining by foreign vertically integrated corporations hungry for raw materials, the most outstanding example being the U.S. steel industry. In addition other international mining companies have spent increasing sums on exploration and development of mines in Canada. The total volume of such foreign capital which theoretically might be invested in Canada is enormous, and it would be impossible and pointless to attempt to measure it. What is important is the extent to which a portion of such funds might be attracted to Canada, and this depends on many factors. As mentioned earlier there is now ample world capacity for most metals and minerals which are consumed in size, and massive inflows of capital of the kind seen in iron ore and uranium are not to be expected in the coming decade (except for projects already committed).

Beyond that consideration, foreign investment in Canadian mining will depend on the balance of exploration cost and characteristics of orebodies found, operating and transportation cost, taxation, and political atmosphere, (both Dominion and Provincial), compared with the balance of similar factors elsewhere. For instance if the political and economic environment in certain South American countries were to become sufficiently favourable and stable there would be a very considerable increase in exploration and

development of properties there, to such an extent that there would be somewhat less interest in Canada. Again, during the past few years large blocks of capital associated with African mining have been interested in Canada, both in exploration and development of new properties and in buying into existing operations, and this interest is expected to continue.

There are considerable equity funds now in Canada which are available for mining. Once a mining company is successful it typically retains a portion of its cash flow in the hope of developing new mines. This cash is invested in suitable securities so that it can be liquidated on reasonably short notice. When new properties are developed this cash is drained out, but as they too become successful cash returns again. In this way the company's balance of cash and equivalent can swing dramatically up and down over a few years.

At December 31, 1961 holdings of cash and equivalent for the major pools of capital in Canadian mining were as follows:

	<u>(\$ millions)</u>
International Nickel	\$ 65
McIntyre-Falconbridge Group	84
Consolidated Mining & Smelting	63
Noranda Group	63
Hudson Bay Mining	29
Hollinger	27
Uranium Industry	42
Asbestos Corp.	12
7 Others	29
	<hr/>
	\$414
	<hr/>

Rapid cash generation in the uranium companies will continue until their contracts expire, by which time, after complete retirement of debt, the total funds available will be three or four times the total at the end of 1961. This list takes no account of the borrowing power of these companies which in many cases, considering the value of their physical assets, would be much larger than the value of cash and equivalent.

The total of these balances is enough to show that there are adequate funds available in the industry to provide the equity base for development of new mines. The problem at the moment is that in spite of substantially increased exploration expenditures, there are not enough orebodies to develop. This is indicated by the tendency of some of these funds to flow out of the mining industry. For example Rio Algom has offered to pay \$45 million plus stock for the assets of Atlas Steel. Several small companies have turned to real estate. These are permanent investments outside the mining industry.

If orebodies can be found, the most advantageous use for most of these reserve funds is in developing mines and related facilities. The companies which have the cash also have competent staffs in being, skilled in the many aspects of mining - a major advantage over newcomers to the industry.

In the meantime however, funds which eventually will go "into the ground" should be used to the best advantage.

Ten years ago a great deal of such money was invested in long term government bonds. With the miserable experience of such bonds, the companies have been forced to become more sophisticated in their investment policies. Long term bonds are held only when an upswing in the market appears likely. Enough short term bonds are kept to provide funds quickly for new deals and the balance is invested to best apparent advantage. This has often been in common stocks except when the stock market seemed likely to fall.

Reserve funds cannot be invested with only the very long term in view. Unlike a pension fund, a mining company may need its money on a few months notice. Therefore it must hope to take advantage of the major upswings in the stock market but sell when the market is high.

Temporary cash balances are invested in the money market, particularly since 1959 when the high interest rates provided real stimulus to enter the money market. Once routines were established to take advantage of short term loans and paper, the operations were continued through the subsequent period of lower interest rates.

Use of Bank Credit:

As indicated by the table on page 69, the mining industry's use of bank credit grew almost fourfold from 1950 to 1961 but is still not large (particularly if we exclude uranium) compared with the importance of the industry.

Canadian Chartered Bank Loans (\$ millions)

		<u>In all Mining & Mine Products</u>	<u>In Uranium</u>	<u>Net Excluding Uranium</u>
1950:	1st quarter	\$ 19.5		
	2nd "	21.2		
	3rd "	26.0		
	4th "	26.0		
1951:	1st quarter	27.0		
	2nd "	28.8		
	3rd "	33.4		
	4th "	34.9		
1952:	1st quarter	39.4		
	2nd "	40.6		
	3rd "	48.0		
	4th "	45.7		
1953:	1st quarter	58.4		
	2nd "	53.1		
	3rd "	62.0		
	4th "	67.9		
1954:	1st quarter	66.3		
	2nd "	73.8		
	3rd "	72.5		
	4th "	67.7	\$ 0.3	\$ 67.4
1955:	1st quarter	67.7		
	2nd "	62.4		
	3rd "	61.1		
	4th "	63.4	1.5	61.9
1956:	1st quarter	67.2		
	2nd "	79.6		
	3rd "	101.2		
	4th "	101.0	24.2	76.8
1957:	1st quarter	119.3		
	2nd "	146.2		
	3rd "	167.9		
	4th "	169.1	41.3	127.8
1958:	1st quarter	170.0		
	2nd "	157.5		
	3rd "	145.4		
	4th "	135.3	28.7	106.6
1959:	1st quarter	115.7		
	2nd "	114.8		
	3rd "	121.6		
	4th "	110.0	7.7	102.3
1960:	1st quarter	110.1		
	2nd "	101.6		
	3rd "	91.6		
	4th "	85.9	1.0	84.9
1961:	1st quarter	86.4		
	2nd "	95.1		
	3rd "	90.3		
	4th "	101.3	2.6	98.7

Bank loans in mining at December 31, 1961 were \$101 million, 2.9% of loans to all business, even though mining accounts for 5.3% of Gross National Product. Of the two fundamental reasons for the small use of bank credit one is obvious - the abundant liquid resources in the major mining companies.

The other reason is that banks have not encouraged loans for capital purposes. A gap exists in the financial structure, in the area of lending funds for one to six years.

Many new mines are owned partly by vendors who are not flush with cash. The less that can be borrowed from banks, the more the sponsoring company will have to provide and the more equity the vendors will have to give up. Sometimes the mine may be trying to float itself by public subscription without a sponsor. In such cases the prospective rate of cash generation, conservatively projected, may be sufficient to justify considerable use of bank credit, yet the credit is not available because banks feel unable to make capital loans in mining which will not be repaid within one year from the last drawdown. Credit is therefore restricted to working capital, which normally is not needed after the first few years of production, unless the sponsor undertakes to provide funds to pay off the balance of the bank loan one year after the last drawdown. Of course the sponsor can borrow from banks on its own good credit rating if several new projects at once have run it short of cash.

This policy has encouraged the development of mining properties by large Canadian or foreign companies. It is questionable whether the trend to bigness and foreign control,

already strong for other reasons, should be encouraged by our chartered banks. In contrast, independent Canadian companies have made considerable headway in the oil industry, through the term loans freely available under Section 82 of the Bank Act. In fundamental economics, ore in the ground is quite similar to oil in the ground, yet the banks treat them much differently.

If the banks were prepared to make loans of a few years term for capital purposes in mining, the large mining companies might feel less need to build up large reserve funds. With assurance of greater cooperation from the banks in financing new mines, the large companies might commit their funds more readily to real capital investment, instead of maintaining such large security portfolios.

Chapter 8: Rate of Profit, and the Effects of TaxationRate of Profit:

The incentive which can put funds to work developing new mines is prospective profit on the investment, and this prospective profit must be generous to compensate for the risks involved. Once a company has begun to spend money to develop an orebody there is no turning back without losing practically everything that has been spent to date. Most if not all the capital expenditure must be made in one great lump before production commences; for it is usually not possible or economic to start small on a property and then expand as costs and conditions warrant. Considering transportation costs the scrap or resale value of equipment is low, and there can be no recovery of concrete emplacements in the wilderness or holes in the ground. For the mine development company the die is cast; and while the most competent staff possible will be employed there will be no means of recouping increases in capital or operating cost if the estimates have been too low, and usually no means of compensating for reductions in revenue once a mine is in production if the expectations of price for the product have been too optimistic.

There is no hard and fast rule as to what rate of anticipated profitability should be required, but it is generally accepted that return of capital with 10% interest after taxes is a minimum, and in certain situations 15% or 20% must be in sight to offset risk. These rates are

applied on the project as a whole, without regard to the method of financing. The length of time required to repay initial capital (without interest) is a criterion used even more widely than percentage rate of return, and a mine development company will not normally accept a prospective length of payout of more than three to five years in a base metal development. With the more exotic metals which can swing widely in price, a faster return is required.

If these criteria seem generous in relation to other industries, it can only be replied that they are determined by competition. There are a number of domestic and foreign mining groups, amply financed, seeking to develop new mines, and the bottleneck is not shortage of cash and know-how but shortage of economic orebodies.

Governments, both Dominion and Provincial, encourage the mining industry through such services as geological and geophysical surveys, technological research, transportation facilities, CMHA mortgages on housing, etc. The importance of mining in developing remote areas of the country has long been recognized, for a new mining camp not only supports a new community, it also serves as a base for further exploration beyond. But the chief impact of governments on mining is in taxation policy. The development of new mines depends on success in exploration and the prospective length of repayment and rate of return, and mining is encouraged or discouraged to the extent that taxes affect all these conditions.

The Dominion government has adopted tax provisions which are favourable to the mining industry, and it is clear that several new developments would not have been undertaken had these incentive provisions not existed. At present, a \$20 million electrolytic zinc plant is being built at Valleyfield, and two zinc mines in northern Quebec are being developed for a cost of \$35 million. None of these (not to mention others) would be economic without the tax incentives.

The special tax incentives include:

- (1) A three year period of tax exemption for new mines, under which no income tax is levied for three years after the mine reaches a reasonably full rate of production. No depreciation writeoff is taken during this period.
- (2) Writeoff of exploration and preproduction expenses as desired, (after the tax free period expires).
- (3) Capital cost allowances on buildings, machinery and equipment is allowed at 30%, reducing balance system which is faster than is common in other industries. However mining is extremely hard on equipment.
- (4) Depletion allowance, under which 33.1/3% of net profit is deducted before arriving at net taxable profit. In provinces where the corporation income tax rate is 52%, the effect is equivalent to charging 34.67% on net profit before depletion allowance. However to this must be added provincial

mining tax, so that the total burden is 40-45% of net profit before depletion allowance.

(Gold mines are allowed depletion of either 40% or \$4.00 per ounce, whichever is greater).

- (5) Shareholders are also permitted a depletion allowance of up to 20% on dividends from mining companies.

Provincial mining taxes vary across the country, and they must be considered as part of the tax burden. That mineral resources belong to the people is a natural political slogan, but the hard fact is that increases in mining taxes tend to discourage the development of new mines.

Theoretical Example of the Effect of Taxes on Profitability:

The impact of taxation can readily be understood from a theoretical example. Suppose a marginally economic ore-body has been delineated. It will require \$5.3 million to develop, and will afford a cash profit before writeoffs and income taxes of \$1.2 million per year for the first three years (higher than mine average ore is normally mined during the tax-free period), and \$1 million per year for the succeeding seven years. Only ten year's ore is available and for geological reasons there is very little chance of finding additional ore. Because of the nature of the project, return of capital together with 15% interest, after tax, is required.

This theoretical example has been picked so that it will return just the necessary 15% rate of return under present tax legislation. Initial capital is repaid near

the end of the fifth year, and taxes are paid only in the last four years of operation. The total Dominion tax bill is \$0.7 million.

Now suppose the same project is considered without the special tax incentives. There is no tax free period or depletion allowance, and writeoffs are taken at a 15% per annum rate(declining balance). The previously marginal orebody is now sub-marginal. Moreover, it would be impossible to make the orebody economic simply by adding additional ore of the same grade.

To make the theoretical orebody economic in the absence of the tax incentives, an increase in average grade of the ore must be assumed. Assuming the mine lasts ten years, the improvement in grade would have to be sufficient to increase cash profits before tax by 50%. (The details of the calculation are shown in Appendix IV.)

The effect of the tax incentives is plain. By establishing them the government has permitted substantial amounts of mineralized material to be classified as ore capable of being mined.

Practical Examples:

Three actual mines have been considered, with calculations made to determine the average rate of profit

being earned during the life of the mine under actual tax legislation and without the special tax incentives.

The first case is a very successful mine, developed at a capital cost of \$22½ million. The mine has been in production for a few years, and we assume the established pattern of operating costs and revenues will continue for 14 years by which time the ore now indicated will be exhausted. At that time the average rate of return on the original investment will have been 24% per annum - certainly a successful investment!

If there were no tax incentives the rate of return would be only 17% per annum, still substantial but a severe cut from what is actually being accomplished.

The second case is a marginal mine, now in operation. The mine's total life is expected to be eight years. It is projected that this mine will not quite break even, recovering about \$0.5 million less than the original capital cost of \$13 million. Under existing legislation no taxes will be paid, but were there no special tax incentives the loss would increase to \$1.4 million due to required tax payments.

If additional ore is found (which is rather unlikely) the project could earn some increase on the original investment, but this would disappear in taxes were there no tax incentives.

In the third case, a mine actually operated for five years. The loss was \$2.9 million on an original cost of

of \$5.2 million. No income taxes were paid or would have been paid.

Effects of Taxes on the Allocation of Resources:

(1) Provincial Mining Taxes:

Provinces have different rates and rules governing mining tax, and to some extent the provinces are in competition to attract the exploration and development dollar. For example, exploration in British Columbia expanded considerably when that province introduced more favourable mining tax arrangements.

In general it can be said that the industry is quite conscious of the different policies of the provinces, and that the allocation of resources between provinces can be adjusted by changes in those policies.

(2) Federal Taxes:

The tax free period and preproduction writeoffs are fundamental to the economics of developing new orebodies. An increase or reduction in them would cause an immediate increase or reduction in the number of new mines put into production, and an increase or reduction in the size of installation appropriate for certain orebodies containing lower grade material. The amount of exploration done in Canada would also be affected immediately and there would be some impact on activity in the stock market.

The depletion allowance is designed to allow for the depletion of the orebody and its practical effect, appropriately, is to encourage exploration for new mines.

An important incentive to risk funds in exploration is the knowledge that if a new mine is found the return from it will be enhanced by the depletion allowance. An increase or decrease in depletion allowances would have an immediate effect on exploration expenditures. The impact on development of new mines would also be substantial, but not quite so immediate. Depletion does not have a great effect on the calculations required to analyze a new property, and so most properties already known in sufficient detail would still be put into production. However more or less exploration would be undertaken, and so in time the development of new properties would be affected considerably by any significant change in depletion allowances.

Effect of Taxes on the Flows of Capital:

If there were a significant change in the amount of exploration and development activity because of a change in the tax provisions, what would be the effect on the flows of capital? For ease of expression let us consider a reduction in activity due to higher effective tax rates.

Most foreign capital now going into mineral exploration and development in Canada comes for the specific purpose of mining and has no interest in entering other Canadian industries. Foreign capital could be expected to be quite responsive to a change in tax legislation; with higher taxes here the money would simply go to other countries. Such a response would have little direct effect on capital flows out of or into other segments of the Canadian economy. Rather the benefit would be felt almost entirely by mining and/or other industries elsewhere in the world.

With higher effective tax rates here, domestic capital already in the hands of Canadian mining companies would tend to move out of the country as such companies increased their exploration and development efforts abroad. At the moment the U.S.A. and Australia would probably be the chief initial recipients although there would be some movement to many other countries as well. There could also be some movement of capital into other Canadian industry, but it is hard to tell how much. The two chief examples of capital moving out of mining in recent years are Rio Algom and Denison Mines. Rio Algom entered the specialty steel business by buying Atlas Steels, but this is not indicative because a major factor in the calculation was the tax writeoff available in Rio Algom which could only be applied against income from Canadian assets, not from assets abroad. Denison Mines has invested in construction and cement inside Canada, and in a large bakery in the U.S. It is probable that the large Canadian mining companies with a deeper and longer standing commitment to mining than these two uranium companies would be more inclined to utilize their know-how in mining abroad than to enter new industries inside Canada. Several Canadian mining companies already have interests abroad. Some smaller mining companies have used their treasuries to enter other fields, particularly real estate, both at home and abroad.

Most equity capital now raised from the public for mining would probably be available for other domestic investment, but as has been shown earlier in this study such capital is a small portion of the total. Since much of it

is highly speculative or "gambling" money it is hard to tell what might be its alternative disposition.

Funds now provided as debt from lending institutions would be available for use according to the general policies of those institutions.

Chapter 9: Foreign Control in the Canadian Mining Industry

As shown in the following table, 72.5% of the aggregate investment in Canadian mining is controlled abroad (for investments of \$25 million or more). The figure would be still larger if there were added those companies in which substantial blocks of stock are held abroad - large enough to carry considerable influence without constituting formal control.

Control of Mining Enterprises in Canada with an Aggregate Investment of \$25 million or more, End of 1953 and 1960

	Aggregate Investment in Canada	
	1953	1960
	(\$ millions)	
<u>Controlled in -</u>		
United States	\$676	\$1,313
Overseas countries	-	180
Sub-Total, outside Canada	676	1,493
Canada	319	565
Total, all enterprises	995	2,058
	As a per cent of total	
United States	67.9	63.8
Overseas countries	-	8.7
Sub-Total, outside Canada	67.9	72.5
Canada	32.1	27.5
Total, all enterprises	100.0	100.0

Source:- Dominion Bureau of Statistics

The extent to which foreign participation in mining, (or other Canadian industries), should be encouraged or dis-

couraged is an important but difficult question. Canadians have enjoyed the prosperity which came from development of new projects, even though control lay in foreign hands. In some cases a foreign partner can be very helpful in finding markets or providing specialized know-how. On the other hand, if Canada's best trained citizens are to stay in Canada, and if mining operations are to be conducted in accordance with Canadian aims rather than with those of a head office located elsewhere, Canadians should have a greater measure of participation and control in Canadian industry. Often foreign owners will prefer to carry out the further processing of Canadian resources abroad rather than inside Canada.

With the prospect of new mining developments being harder to come by, now may be a difficult time to tighten the terms of foreign investment. On the other hand a decision to invest in Canada rests on a complex of factors, and a requirement that a certain minimum proportion of a new enterprise be owned by Canadians who would put up their pro rata share of capital should not be a serious impediment. Foreigners might even regard Canadian participation as offering a measure of political protection in the long run.

Foreign purchase of control in existing operations is a somewhat different problem, since it does not carry with it directly any new development which might not otherwise have been undertaken. Canadian shareholders have been quick to accept good prices for their shares, regardless of whose money they were taking.

It would be possible to encourage Canadian participation in the mining industry, by applying either regulation or tax incentives to new properties. This would not affect established operations under foreign control, all of which will eventually become exhausted. If every new operation had Canadian participation, in time all mining operations would have that participation.

Such a proposal leads immediately to the question Are there sufficient equity funds in Canada to support it. The answer clearly is affirmative.

Chapter 10: Refining and Fabricating Minerals in Canada

That more of our raw materials should be further processed in Canada has been a recurring political theme. The aim is worthy, but the problem is complex and its resolution requires a nice balance of many factors.

As indicated in a previous chapter, most new mines in Canada will be developed by a sponsoring company - either an existing mine or a consumer (or group of consumers) of the product. Those that achieve production on their own will probably ship concentrate to a smelter. It takes a very substantial orebody to justify the cost of building a smelter, and it is unlikely that an orebody of such importance would be developed without a sponsor. (If the sponsor is a foreign company, it may prefer to ship concentrate to its smelter abroad). Taxation policy encourages the building of a smelter and/or refinery simultaneously with the development of the mine, since the incentive provisions, including the initial three year tax free period, apply to processing of the metal right up to its pure state.

Besides sufficient ore in sight, a smelter requires capital, power, labour and markets for its products, (the latter depend on freight rates), and the location of a smelter is determined by the balance of all these factors. At this time it would be very difficult to justify building a copper smelter in Canada near salt water, because Japan is so eager for copper concentrate to feed its own works that it maintains a subsidy of about 4¢ per lb. This

enables Japanese smelters to give good enough terms for copper concentrate to render uneconomic the building of a new smelter in Canada. Similarly some European smelters are hungry for concentrate. At the same time such terms also enable marginal deposits to be developed which otherwise might be discarded.

The large cost of a smelter or refinery can usually be amortized over many years, and so it is suitable for considerable debt financing. This means that the cost of interest is significant, and changes in the cost or availability of funds can affect the timing of construction. Similarly government can encourage the building of such facilities by guaranteeing bonds to lower the interest cost, as has been promised in New Brunswick.

Once a smelter has been built it frequently accepts shipments from other mines for processing on a toll basis. The presence of a custom smelter encourages the development of other mines which otherwise might be uneconomic. Once a smelter has been built it is usually cheaper to expand its capacity than to build another new smelter in the same area.

Fabricating Canadian metals and minerals in Canada is subject to the problems of all secondary industry in this country - the small market and the cost structure including taxes. In addition, as can be seen in the table on page 87, foreign tariffs rise with the degree of manufacture, and this tends to discourage export of Canadian metals in

Tariffs Against Canadian Metals

<u>Commodity</u>	<u>U.S. Effective Reduced Rate</u>	<u>U.K. Commonwealth</u>	<u>E.C.M. Full Rate</u>
<u>Iron:</u>			
Iron Ore	Free	Free	Free
Pig Iron	20¢/ton	Free	1%
Hollow Drill Steel	3.8¢/lb + 10%	Free	5% W. Germany
Boiler or Other Plate	9%	Free	5% W. Germany
<u>Copper:</u>			
Copper Concentrate	1.7¢/lb	Free	Free
Refinery Shapes	1.7¢/lb of contained copper	Free	Free
Copper Rods	1½¢/lb + 1.7¢/lb of contained copper	Free	10%
Copper Sheets	1½¢/lb + 1.7¢/lb of contained copper	Free	10%
Copper Tubes	3½¢/lb + 1.7¢/lb of contained copper	Free	13%
<u>Zinc:</u>			
Zinc Concentrates	0.6¢/lb of con- tained zinc	Free	Free
Zinc Blocks	0.7¢/lb	Free	0.6¢/ lb
Zinc Sheets	1.0¢/lb	Free	10%
Zinc Products	19%	Free	16%
<u>Nickel:</u>			
Nickel Ores	Free	Free	Free
Nickel Pigs	1½¢/lb	Free	Free
Nickel Screws	20%	Free	13%
<u>Lead:</u>			
Lead Ores	¾¢/lb of con- tained lead	Free	Free
Lead Pigs	1.1/16¢/lb of contained lead	Free	0.6¢/ lb
Lead Pipe	1.5/16¢/lb	Free	13%
<u>Aluminum:</u>			
Bauxite	50¢/ton suspended	Free	Free
Aluminum Ingots	1½¢/lb	Free	10%
Aluminum Rods & Bars	2½¢/lb	Free	15%
<u>Asbestos:</u>			
Crude	Free	Free	Free
Asbestos Cloth	9%	Free	17%
Asbestos Pipes	0.3¢/lb	Free	10%

manufactured forms. Foreign countries want our ores, but prefer to smelt, refine and fabricate themselves.

That most Canadian base metals are exported in an unfabricated state is shown by the following table of exports in 1961:

		(\$ millions)
<u>Copper:</u>		
Concentrates		\$ 18.6
<u>Refinery Shapes</u>		154.4
Fabricated Products:		
Bars, Rods	\$10.8	
Plates, Sheet	2.0	
Pipe, Tubing	6.5	
Other	<u>2.3</u>	21.6
<u>Zinc:</u>		
Concentrates		16.4
<u>Blocks, Pigs, Slabs</u>		42.0
Fabricated Materials n.e.s.		0.2
<u>Nickel:</u>		
Ores and Concentrates		128.1
Oxide		22.9
<u>Anodes, Ingots, Cathodes</u>		187.2
Fabricated Materials n.e.s.		4.4
<u>Aluminum:</u>		
Ores and Concentrates		1.2
<u>Pigs, Ingots, Slabs</u>		221.5
Fabricated Products:		
Bars, Rods, Plates	\$13.9	
Fabricated Materials	<u>6.2</u>	20.1
n.e.s.		

Of course base metals enter into other manufactured goods which are exported under different categories, but it

is clear that most is exported as ores and concentrates, and smelted or refined metal.

As to the relative amounts exported as ores and concentrates vs smelted and refined metal, it must be remembered that the value of metal in concentrate is less than in pure metal by the amount of the smelting and refining tolls, etc. Thus for example \$16.4 million of zinc concentrates represents a volume of contained metal roughly equivalent to the \$42.0 million of blocks, pigs and slabs. The point is that while considerable progress has been made in smelting and refining of metals in Canada, much is still exported as ores and concentrates and comparatively little in fabricated form.

The future of Vertical Integration:

Increasingly metal producers around the world are turning to vertical integration as an aid to selling their products. This trend can be seen in iron, zinc, copper, aluminum and asbestos. Since Canadian companies must find much of their market abroad, the integration cannot be only domestic, but must include processors and fabricators abroad. So too foreign integrated companies are extending into Canada, both in the search for new mines and in buying into existing Canadian operations. As world trade becomes more closely knit the trend towards international vertical integration will continue, and the position of the un-integrated seller of metal or mineral will become increasingly precarious.

Projecting Metal Prices

Of all long term economic projections, those involving prices of specific goods are probably the most difficult. Yet for mining a long term projection is usually necessary. It takes courage to hold fast to a long term view of price when the immediate price is substantially higher or lower.

The best techniques available for estimating metal prices involve projecting physical consumption of the metal by correlation with G.N.P. and population, or by simple extension of a long term rate of growth. Allowance must be made for metal recovered from scrap for re-use. Consumption figures for the 1950's are distorted by stockpiling.

On the supply side, it is necessary to determine the cost of production of metal from existing mines and likely additions. Sir Ronald Prain has given some useful estimates for copper. However published information is scanty, and clouded by the presence of joint products - such as precious metals found with base metals, and lead and/or zinc and/or copper and/or nickel being found together.

Another technique, just one step beyond projecting past average prices, is to compute the total dollar amount paid for a metal in the past as compared with total dollar value of industrial production, then ^{to} project the relationship into the future. Comparison with a projection of physical demand for the metal gives a projected price.

From time to time long-term projections of metal prices have appeared in professional journals. Of particular interest have been articles by Mr. William P. Shea in the Engineering and Mining Journal.

THIS AGREEMENT made in duplicate this _____ day
of _____, A.D. 19__.

BETWEEN ABC Exploration Limited
(No Personal Liability), (hereinafter
called the "Company")

OF THE FIRST PART:

- and -

(Hereinafter called the "Prospector")

OF THE SECOND PART.

WHEREBY IT IS AGREED AS FOLLOWS:

1. The Company shall employ the Prospector at a salary
of (\$_____) per month and a further consideration here-
inafter set forth.
2. The Prospector will:
 - (a) Diligently prospect for mines during the currency
of this agreement and locate, stake out and record
mining claims and all such mining claims shall be
recorded in or transferred to such names as the
Company shall direct, and unless the Company consents
in writing, the Prospector agrees not to hold or
acquire claims or an interest in any claims either
directly or through another party, except on behalf
of the Company.
 - (b) Report in writing to the Company weekly giving full
details of the territory covered, claims staked if
any, and all pertinent information which he may
obtain.
 - (c) Obey and comply with all instructions and directions
given to him by the Company or its duly authorized
agent or agents.
3. The Company will:
 - (a) Reimburse the Prospector for all reasonable and
necessary expenses for food and travel provided a
proper accounting for such expenses is submitted at
least monthly.

- (b) Furnish the Prospector with all necessary prospecting equipment, excepting clothing and bedding, such equipment to be returned to the Company at the expiration of the period.

4. A Prospector who during the currency of this Agreement:

- (a) By his own initiative, stakes claims to cover a discovery surface showing, or a known occurrence of valuable mineral in place shall be entitled to _____ (____) per cent interest in the usual vendor's share of any new Company formed by the Company on said claims or in any other fair sale consideration received by the Company in respect to said claims.
- (b) By his own initiative, selects ground by merit of location or geology, or by merit of geophysical, geochemical, or mineralized float indications and causes it to be staked on behalf of the Company shall be entitled to an interest of five per cent (5%) in the vendor's consideration received by the Company, even though no showing of mineral in place has been found by the Prospector.
- (c) Recommends to the Company a property that has not previously been brought to its attention and where in consequence of such recommendation the Company acquires the said property or an interest therein within two years of such recommendation, shall be entitled to two per cent (2%) of the consideration which the Company receives for such property or its interest therein.

- 5.(a) The Prospector's interest shall be non-assessable in regard to development work on the claims or maintaining the claims in compliance with local mining regulations.

The Prospector is entitled to no further interest participation than outlined in clause 4.

- (c) In the case where a prospecting party consists of two or more Prospectors under contract to the Company, only one interest can be earned, and any interest earned under clause 4(a) or 4(b) by any of the said Prospectors, and payments under clause 7, if any, shall be divided between them equally or in accordance with any prior supplementary agreement in writing between them.
- (d) Where staking of a block of claims is done by the Prospector acting under instructions from the Company, the Prospector is not entitled to an interest in the claims.

- e. The Prospector hereby grants the Company an exclusive option to purchase within 5 years of the date of recording claims, any interest the Prospector may become entitled to under this contract for a consideration of \$10,000 for each 1% of interest held.

7. It is understood and agreed that the manner in which the claims shall be developed, and the manner in which and the terms upon which all or any such claims including the interest of the Prospector shall be disposed of, shall be in the absolute discretion of the Company and the Company may allow all or any of the claims to lapse.
8. It is understood and agreed that if within two years of the date of staking any diamond drilling is done by the Company on any mining claim or claims in which the Prospector is entitled to an interest under clause 4(a) or 4(b) the Prospector shall also be entitled to receive 35¢ per foot for each foot drilled up to and including 10,000 feet. Such payments, if any, shall be made to the Prospector monthly based on footage drilled during the month.
9. Provided that such service and this agreement may be terminated by the Company giving to the Prospector thirty (30) days notice in writing or at the option of the Company on payment by the Company to the Prospector of one month's salary.
10. Such services shall begin by or before the _____ day of _____ 19____, and terminate _____ () months thereafter. At the termination of this agreement the Prospector shall be entitled to any interest in mining claims and properties which may accrue to him for services during the term of this agreement.

IN WITNESS WHEREOF the parties hereto have hereunto set their hands and seals.

SIGNED, SEALED AND DELIVERED)

ABC EXPLORATION LIMITED
(No Personal Liability)

by _____

and _____

Witness

Prospector

MEMORANDUM OF OPTION AGREEMENT

1. In consideration of the sum of \$50.00 (hereby acknowledged) _____

_____, as Optionor(s), doth (do) hereby give and grant unto

_____, as Optionee, the sole and exclusive right and option to acquire for the undermentioned New Company the following mining property, which the Optionor(s) represent(s) that he (it) (they) owns (own), free of encumbrances, viz:

2. The said option may be exercised on or before September 1 19⁶⁷ (5 yrs), by notice of exercise thereof addressed to the Optionor(s) as above.

3. If it desires to keep its said option in good standing the Optionee shall pay to the Optionor(s) the sum of \$50,000 as follows:

the aforesaid sum of \$50.00 paid herewith;

the further sum of \$10,000 payable on or before the Sept. 1 19⁶³ or the date of completion of the under-

mentioned escrow deposit, whichever is the later date;

the further sum of \$10,000 on or before Sept. 1 19⁶⁴;

the further sum of \$10,000 on or before Sept. 1 19⁶⁵;

the further sum of \$10,000 on or before Sept. 1 19⁶⁶;

the remaining \$9,950 on or before Sept. 1 19⁶⁷.

Any of such cash payments which the Optionee desires to make may be made to Bank _____ for the account of the Optionor(s).

4. If the said option hereby granted be exercised the said mining property shall be transferred to a New Company which the Optionee will cause to be formed to acquire the same. If formed, the New Company shall have an authorized capital of 3,000,000 shares but all other particulars and details with respect to the New Company shall be in the sole discretion of the Optionee; and the consideration to be paid by the New Company for the said mining property shall be such number of fully paid shares of the New Company as the Optionee may, in its sole discretion, determine, provided that _____ of the shares comprised in such consideration shall be allotted and issued to the Optionor(s) and the remainder of the shares comprised in such consideration shall be allotted and issued to the Optionee as compensation for the Optionee's expenditures on or in connection with the said mining property and other expenses in connection with the said transaction, including cash payments made to the Optionor(s). Certificates for the said _____ shares of the New Company to which the Optionor(s) may become entitled hereunder shall be delivered to the said _____ for the account of the Optionor(s) within three months after the said option be exercised, subject to the regulations of the Securities Commission applicable thereto.

5. The Optionor(s) will forthwith execute good and sufficient transfers of the said mining property to an unnamed transferee and deposit the same together with title documents in escrow with said _____, with instruction (in form approved by the Optionee) to deliver the same to the Optionee upon receipt of the aforesaid cash and stock payments together with a declaration on behalf

of the Optionee that the said option has been duly exercised and the New Company formed.

6. The Optionee shall be entitled to possession of and may examine and explore the said mining property during the currency of the said option and may remove anything brought by it thereon during such period.

7. Time shall be of the essence of the said option hereby granted; provided nevertheless that if the Optionee should be delayed in or prevented from examining and exploring the said mining property by strikes, government regulations or other causes beyond the control of the Optionee, the time within which the said option may be exercised and the time for making each of the aforesaid cash and stock payments shall be extended by the total period of all such delays.

8. If the said option hereby granted is not exercised, the Optionee, will, on request, deliver to the Optionor one set of plans and records that will show the essential results of its investigation of the said mining property; and if any diamond drilling has been done then the cores, except portions taken for assay purposes, shall be left on the property.

9. This is an Option Agreement only and the Optionee is not obligated to make any payments or expenditures or to form the New Company or to do anything else hereunder and the Optionee may at any time abandon the said option by giving notice to that effect to the Optionor(s) addressed as above.

10. The Optionee will, during the currency of the said

Appendix III

Gross Value of Mine Production in Canada (1926-1960) *

(in thousands of dollars)

Year	Total	Metal Mining(a)	Coal Mining	Industrial Mineral Mining(b)	Value of Output as Percentage of Total		
					Metal Mining	Coal Mining	Industrial Mineral Mining
1926	173,455	98,679	56,494	18,282	56.9	32.6	10.5
1939	335,679	273,746	38,063	23,870	81.5	11.3	7.1
1950	677,629	473,291	110,140	94,198	69.8	16.3	13.9
1	772,249	549,498	109,039	113,712	71.2	14.1	14.7
2	767,995	535,126	111,026	121,843	69.7	14.5	15.9
3	708,750	486,048	102,722	119,980	68.6	14.5	16.9
4	774,691	555,989	96,600	122,102	71.8	12.5	15.8
5	903,709	669,762	93,579	140,368	74.1	10.4	15.5
6	991,644	743,722	95,350	152,572	75.0	9.6	15.4
7	1,040,570	791,257	90,221	159,092	76.0	8.7	15.3
8	1,085,874	864,084	79,963	141,827	79.6	7.4	13.1
9	1,266,767	1,023,962	73,876	168,929	80.8	5.8	13.3
1960	1,260,394	1,003,696	74,676	182,022	79.6	5.9	14.4

* Value of all oil and gas production is excluded

(a) Includes gold, but excludes the value of all smelting and refining

(b) Includes asbestos, gypsum, mica, salt, nepheline syenite, feldspar, quartz, ochres talc, soapstone, etc.

Source: D.B.S. Mineral Statistics.

Value of Exports of Metals and Industrial Minerals from Canada 1926-1961(a)

(in thousands of dollars)

Year	Total(b)	Metals	Industrial Minerals	Percentage of Total Mineral Exports	
				Metals	Industrial Minerals
1926	86,224	74,600	11,624	86.5	13.5
1939	193,006	176,090	16,916	91.2	8.8
1950	546,694	480,335	66,359	87.9	12.1
1	677,321	592,144	85,177	87.4	12.6
2	784,554	691,862	92,692	88.2	11.8
3	804,334	712,499	91,835	88.6	11.4
4	829,128	738,810	90,318	89.1	10.9
5	1,044,068	941,173	102,895	90.1	9.9
6	1,234,698	1,126,595	108,103	91.2	8.8
7	1,312,131	1,201,236	110,895	91.5	8.5
8	1,232,420	1,133,722	98,698	92.0	8.0
9	1,390,591	1,266,244	124,347	91.1	8.9
1960	1,515,261	1,372,026	143,235	90.5	9.5
1	1,507,281	1,356,434	150,847	90.0	10.0

(a) In the form of ores, concentrates, and primary manufactures only.

(b) Excludes gold and mineral fuels, (but includes Aluminum)

Source: D.B.S. Trade of Canada

Value of Exports of Mineral Ores, Concentrates
and Primary Manufactures from Canada
1926-1961(a)
(in thousands of dollars)

Year	Total	Ores and Concentrates	Primary Manufactures	Percentage of Total Mineral Exports	
				Ores and Concentrates	Primary Manufactures
1926	90,926	32,460	58,466	35.7	64.3
1939	199,481	49,068	150,413	24.6	75.4
1950	566,381	170,266	396,115	30.1	69.9
1	704,448	221,467	482,981	31.4	68.6
2	807,234	255,344	551,890	31.6	68.4
3	839,762	282,374	557,388	33.6	66.4
4	863,439	286,963	576,476	33.2	66.8
5	1,083,141	374,308	708,833	34.6	65.4
6	1,278,396	490,015	788,381	38.3	61.7
7	1,361,778	582,093	779,685	42.7	57.3
8	1,266,932	643,538	623,394	50.8	49.2
9	1,435,518	759,064	676,454	52.9	47.1
1960	1,560,665	740,359	820,306	47.4	52.6
1	1,550,279	712,967	837,312	46.0	54.0

(a) Excludes gold and the mineral fuels, but includes aluminum.

Source: D.B.S. Trade of Canada

Value of Exports of Non-Ferrous Metals (a)
from Canada 1926-1961
(in thousands of dollars)

Year	Total	Ores and Concentrates	Primary Manufactures	as Percentage of Total	
				Ores and Concentrates	Primary Manufactures
1926	70,425	19,941	50,484	28.3	71.7
1939	169,858	30,400	139,458	17.9	82.1
1950	426,585	85,898	340,687	20.1	79.9
1	526,151	112,300	413,851	21.3	78.7
2	609,930	135,592	474,338	22.2	77.8
3	619,064	153,626	465,438	24.8	75.2
4	665,363	150,443	514,920	22.6	77.4
5	773,562	159,732	613,830	20.6	79.4
6	909,800	222,203	687,597	24.4	75.6
7	959,530	303,218	656,312	31.6	68.4
8	982,665	425,412	557,253	43.3	56.7
9	1,057,311	459,758	597,553	43.5	56.5
1960	1,143,367	428,023	715,344	37.4	62.6
1	1,129,733	405,038	724,695	35.9	64.1

(a) Excludes gold, but includes aluminum.

Source: D.B.S. Trade of Canada.

Value of Exports of Non-Metallic Minerals (a)
From Canada 1926-1961
 (in thousands of dollars)

Year	Total	Ores and Concentrates	Primary Manufactures	as Percentage of Total	
				Ores and Concentrates	Primary Manufactures
1926	16,326	12,512	3,814	76.6	23.4
1939	23,391	18,625	4,766	79.6	20.4
1950	86,046	71,058	14,988	82.6	17.4
1	112,304	90,571	21,733	80.6	19.4
2	115,372	97,419	17,953	84.4	15.6
3	127,263	97,905	29,358	76.9	23.1
4	124,629	96,801	27,828	77.7	22.3
5	141,968	114,762	27,206	80.8	19.2
6	151,801	123,369	28,432	81.3	18.7
7	160,542	126,594	33,948	78.9	21.1
8	133,210	110,453	22,757	82.9	17.1
9	169,274	141,491	27,783	83.6	16.4
1960	188,639	156,864	31,775	83.2	16.8
1	193,845	165,363	28,482	85.3	14.7

(a) Excluding mineral fuels.

Source: D.B.S. Trade of Canada.

Value of Imports of Metals, Industrial Minerals
Into Canada
1926-1961(a)
 (in thousands of dollars)

Year	Total	Metals	Industrial Minerals	Percentage of Total Imports	
				Metals	Industrial Minerals
1926	26,438	20,434	6,004	77.3	22.7
1939	28,640	18,496	10,144	64.6	35.4
1950	119,090	92,724	26,366	77.9	22.1
1	159,122	129,642	29,480	81.5	18.5
2	171,640	140,059	31,581	81.6	18.4
3	140,668	107,071	33,597	76.1	23.9
4	116,936	85,766	31,170	73.3	26.7
5	159,015	121,921	37,094	76.7	23.3
6	225,108	178,806	46,302	79.4	20.6
7	215,105	170,830	44,275	79.4	20.6
8	152,424	114,323	38,101	75.0	25.0
9	178,198	137,247	40,951	77.0	23.0
1960	212,484	170,775	41,709	80.4	19.6
1	228,655	185,500	43,155	81.1	18.9

(a) in the form of ores, concentrates and primary manufactures only.
 Excludes gold and the mineral fuels.

Source: D.B.S. Trade of Canada.

Value of Imports of Mineral Ores, Concentrates
and Primary Manufactures into Canada
1926-1961(a)
(in thousands of dollars)

Year	Total	Ores and Concentrates	Primary Manufactures	Percentage of Total Mineral Imports	
				Ores and Concentrates	Primary Manufactures
1926	26,885	13,359	13,526	49.7	50.3
1939	29,939	15,630	14,309	52.2	47.8
1950	124,578	65,034	59,544	52.2	47.8
1	167,955	89,861	78,094	53.5	46.5
2	178,943	97,347	81,596	54.4	45.6
3	147,284	84,054	63,230	57.1	42.9
4	124,022	71,518	52,504	57.7	42.3
5	167,799	95,083	72,716	56.7	43.3
6	234,661	119,460	115,201	50.9	49.1
7	225,252	135,646	89,606	60.2	39.8
8	161,988	99,701	62,287	61.5	38.5
9	188,338	106,862	81,476	56.7	43.3
1960	221,655	138,748	82,907	62.6	37.4
1	238,785	152,325	86,460	63.8	36.2

(a) Excludes gold and mineral fuels.

Source: D.B.S. Trade of Canada.

Value of Imports of Non-Ferrous Metals (a)
Into Canada 1926-1961
(in thousands of dollars)

Year	Total	Ores and Concentrates	Primary Manufactures	Percentage of Total Imports	
				Ores and Concentrates	Primary Manufactures
1926	15,054	4,827	10,227	32.1	67.9
1939	11,355	5,328	6,027	46.9	53.1
1950	65,796	28,084	37,712	42.7	57.3
1	87,469	41,926	45,543	47.9	52.1
2	90,115	46,996	43,119	52.1	47.9
3	70,041	29,783	40,258	42.5	57.5
4	58,366	26,410	31,956	45.2	54.8
5	69,347	35,558	33,789	51.3	48.7
6	94,652	46,829	47,823	49.5	50.5
7	106,282	66,591	39,691	62.7	37.3
8	69,584	39,297	30,287	56.5	43.5
9	75,770	46,743	29,027	61.7	38.3
1960	90,344	55,453	34,891	61.4	38.6
1	116,584	69,275	47,309	59.4	40.6

(a) Excludes gold but includes aluminum.

Source: D.B.S. Trade of Canada.

Value of Imports of Non-Metallic Minerals
Into Canada 1926-1961(a)
(in thousands of dollars)

Year	Total	Ores and Concentrates	Primary Manufactures	Percentage of Total Imports	
				Ores and Concentrates	Primary Manufactures
1926	6,451	5,678	773	88.0	12.0
1939	11,443	6,123	5,320	53.5	46.5
1950	31,854	20,148	11,706	63.3	36.7
1	38,313	25,264	13,049	65.9	34.1
2	38,884	23,832	15,052	61.3	38.7
3	40,213	26,077	14,136	64.8	35.2
4	38,256	24,692	13,564	64.5	35.5
5	45,878	27,962	17,916	60.9	39.1
6	55,855	33,909	21,946	60.7	39.3
7	54,422	32,668	21,754	60.0	40.0
8	47,665	31,473	16,192	66.0	34.0
9	51,091	32,990	18,101	64.6	35.4
1960	50,880	34,925	15,955	68.6	31.4
1	53,285	35,617	17,668	66.8	33.2

(a) Excludes mineral fuels.

Source: D.B.S. Trade of Canada

Value of the Domestic Supply of Mineral Ores,
Concentrates and Primary Manufactures in Canada
1926-1961(a)
(in thousands of dollars)

Year	Production ^(b)	Imports	Exports	Domestic Supply	Imports as a Percentage of Domestic Supply
					Supply
1926	145,936	26,885	90,926	81,895	32.8
1939	256,265	29,939	199,481	86,723	34.5
1950	800,586	124,578	566,381	358,783	34.7
1	1,002,769	167,955	704,448	466,276	36.0
2	1,048,427	178,943	807,234	420,136	42.6
3	1,088,739	147,284	839,762	396,261	37.2
4	1,198,659	124,021	863,439	459,241	27.0
5	1,474,612	167,799	1,083,141	559,270	30.0
6	1,697,739	234,661	1,278,396	654,004	35.9
7	1,749,578	225,252	1,361,778	613,052	36.7
8	1,726,323	161,988	1,266,932	621,379	26.1
9	1,990,306	188,338	1,435,518	743,126	25.3
1960	2,123,842	221,655	1,560,665	784,832	28.2
1	2,082,056	238,785	1,550,279	770,562	31.0

(a) Excludes gold, and mineral fuels.

(b) Includes estimate for aluminum production.

Source: D.B.S. Trade of Canada and Mineral Statistics.

Employment in Mining, Canada 1926-1960
(by number of employees)*

Year	Total	Metal Mining	Coal Mining	Industrial Mineral Mining	Employment as Percentage of Total		
					Metal Mining	Coal Mining	Industrial Mineral Mining
1926	51,794	17,516	28,368	5,910	33.8	54.7	11.4
1939	78,241	45,594	26,472	6,175	58.3	33.8	7.9
1950	81,231	47,697	23,418	10,116	58.7	28.8	12.5
1	85,529	52,271	22,647	10,611	61.1	26.5	12.4
2	88,339	55,338	21,754	11,247	62.6	24.6	12.7
3	82,657	51,711	19,847	11,099	62.6	24.0	13.4
4	80,541	51,599	18,050	10,892	64.1	22.4	13.5
5	81,676	53,364	16,590	11,722	65.3	20.3	14.4
6	86,207	57,564	16,095	12,548	66.8	18.7	14.6
7	89,433	62,554	14,569	12,310	69.9	16.3	13.8
8	86,821	61,999	13,162	11,660	71.4	15.2	13.4
9	87,075	63,871	11,485	11,719	73.4	13.2	13.5
1960	84,675	61,882	11,587	11,206	73.1	13.7	13.2

* Excludes employment in oil and gas industry.

Source: D.B.S. Mineral Statistics of Canada.

Canadian Mineral Industry, Salaries and Wages
as a Percentage of Gross and Net Value of
Production(a). Five-Year Periods, 1926-1961
(in thousands of dollars)

Period	Gross Value of Production	Net Value of Production	Salaries and Wages	Salaries and Wages as a Percentage of	
				Gross	Net
<u>Metal Mines</u>					
1926-30	435,992	413,568	170,864	39.2	41.3
1936-40	1,223,258	944,495	368,353	30.1	39.0
1946-50	1,834,450	1,377,707	563,281	30.7	40.9
1951-55	2,796,426	1,972,523	966,377	34.6	49.0
1956-60	4,426,721	3,075,175	1,426,083	32.2	46.4
<u>Industrial Minerals</u>					
1926-30	98,443	89,199	33,133	33.7	37.1
1936-40	105,170	80,742	32,171	30.6	39.8
1946-50	323,616	255,240	98,026	30.3	38.4
1951-55	618,005	498,684	184,198	29.8	36.9
1956-60	804,442	647,013	240,809	29.9	37.2
<u>Total Mining excluding smelting and refining(b)</u>					
1926-30	534,435	502,767	203,997	38.2	40.6
1936-40	1,328,428	1,025,237	400,524	30.2	39.1
1946-50	2,158,066	1,632,947	661,307	30.6	40.5
1951-55	3,414,431	2,471,207	1,150,575	33.7	46.6
1956-60	5,231,163	3,722,188	1,666,892	31.9	44.8
<u>Smelting and Refining</u>					
1926-30	294,563	264,250	61,502	20.9	23.3
1936-40	1,403,274	438,293	93,025	6.6	21.2
1946-50	2,603,208	716,816	237,574	9.1	33.1
1951-55	4,703,603	1,635,944	478,770	10.2	29.3
1956-60	6,615,656	2,277,555	686,906	10.4	30.2

(a) Excludes mineral fuels.

(b) Smelting and refining excluded from total to avoid double counting.

Source: D.B.S. Mineral Statistics

Iron Ore Production, Exports and Consumption
1921-1961

	C a n a d a			Production as % of World	World(c)	North America(d)
	(a)	(b)	(a)			
	Production	Exports	Consumption	Production	Production	Consumption
	(In millions of long tons)				(In millions of long tons)	
1921	0.1	-	1.2	0.1	72.0	30.3
1939	0.1	-	1.4	0.1	183.4	54.8
1950	3.2	2.0	3.9	1.3	241.9	110.5
1951	4.2	2.9	4.4	1.5	283.8	119.2
1952	4.7	3.4	4.6	1.7	284.1	105.2
1953	5.8	4.3	4.9	1.7	336.5	129.7
1954	6.6	5.5	3.5	2.2	303.0	97.7
1955	14.5	13.0	5.1	3.9	368.6	130.1
1956	20.0	18.1	6.2	5.1	394.5	131.4
1957	19.0	18.0	6.4	4.5	426.5	135.8
1958	14.0	12.4	5.2	3.5	398.6	97.1
1959	21.9	18.6	6.8	5.1	431.7	100.8
1960	19.2	16.9	6.4	3.8	507.1	108.7
1961	18.2	14.9	7.1	3.6	504.7	104.8

Sources: (a) D.B.S. Mineral Statistics of Canada.
 (b) D.B.S. Trade of Canada.
 (c) American Iron and Steel Institute.
 (d) North American consumption -
United States (American Iron and Steel Institute)
Canada (D.B.S. Mineral Statistics of Canada)

Nickel Production, Exports and Consumption
1921-1961

	C a n a d a			Production as % of World	World (c)	North American (d)
	(a)	(b)	(a)			
	Production	Exports	Consumption	Production	Production	Consumption
	(In thousands of short tons)				(In thousands of short tons)	
1921	10	6	-	87.3	11	-
1939	113	117	1	83.8	135	53
1950	124	122	2	76.5	162	101
1	138	131	3	76.2	181	89
2	141	142	2	69.8	202	104
3	144	146	2	66.1	218	107
4	161	159	3	67.6	238	97
5	175	174	5	66.5	263	115
6	179	177	5	63.0	284	133
7	188	179	4	59.9	314	127
8	140	154	4	56.2	249	83
9	187	172	4	60.3	310	116
1960	214	195	5	59.6	359	113
1961	238	244	5	59.8	398	123

Sources: (a) D.B.S. Mineral Statistics of Canada
 (b) D.B.S. Trade of Canada
 (c) American Bureau of Metal Statistics
 (d) North American consumption:
United States - United States Bureau of Mines Minerals Yearbook
Canada - D.B.S. Mineral Statistics of Canada

Copper Production, Exports and Consumption,
1921-1961

Year	C a n a d a			Production as % of World Production	World Production (c)	North American Consumption (d)
	(a)	(b)	(a)			
	Production (in thousands of short tons)	Exports	Consumption			
1921	24	21	14	3.9	614	319
1939	304	242	57	12.6	2,411	772
1950	264	167	107	9.6	2,761	1,554
1	270	167	134	9.3	2,893	1,576
2	258	148	130	8.4	3,066	1,490
3	253	183	109	8.2	3,072	1,552
4	303	204	102	9.8	3,093	1,311
5	326	195	139	9.6	3,405	1,585
6	355	216	145	9.4	3,761	1,611
7	359	245	118	9.3	3,863	1,396
8	345	255	123	9.2	3,752	1,302
9	395	254	130	9.8	4,015	1,442
1960	439	326	118	9.7	4,539	1,397
1	445	309	142	9.5	4,678	1,567

Sources: (a) Mineral Statistics of Canada.
 (b) Trade of Canada.
 (c) American Bureau of Metal Statistics.
 (d) North American Consumption -
United States - Minerals Yearbooks: United States Bureau of Mines.
Canada - D.B.S. Mineral Statistics of Canada.

Zinc Production, Exports and Consumption,
1921-1961

Year	C a n a d a			Production as % of World Production	World Production (c)	North American Consumption (d)
	(a)	(b)	(a)			
	Production (in thousands of short tons)	Exports	Consumption			
1921	27	24	-	4.5	592	-
1939	197	177	23	11.0	1,800	599
1950	313	276	54	13.4	2,341	955
1	341	301	61	13.5	2,518	947
2	372	349	52	13.6	2,726	905
3	402	351	51	14.2	2,836	1,037
4	377	386	47	13.4	2,823	931
5	433	404	58	14.0	3,091	1,178
6	423	383	61	12.8	3,293	1,070
7	414	389	53	12.4	3,334	989
8	425	414	56	13.0	3,258	924
9	396	361	65	12.0	3,301	1,021
1960	407	377	56	11.6	3,516	934
1961	412	408	61	12.1	3,399	970

Sources: (a) D.B.S. Mineral Statistics of Canada.
 (b) D.B.S. Trade of Canada.
 (c) American Bureau of Metal Statistics.
 (d) North American consumption -
United States - Minerals Yearbooks: United States Bureau of Mines.
Canada - D.B.S. Mineral Statistics of Canada.

Lead Production, Exports and Consumption,
1921-1961

Year	C a n a d a			Production as % of	World	North American
	(a)	(b)	(a)	World	(c)	(d)
	Production	Exports	Consumption	Production	Production	Consumption
	(in thousands of short tons)			(in thousands of short tons)		
1921	33	21	-	3.4	974	-
1939	194	185	27	10.2	1,907	568
1950	166	134	55	9.0	1,837	940
1	158	125	60	8.5	1,854	738
2	169	154	63	8.6	1,967	844
3	194	165	68	9.5	2,035	852
4	219	176	68	10.2	2,142	831
5	203	151	76	9.0	2,268	886
6	189	130	76	8.1	2,330	819
7	182	129	72	7.2	2,536	774
8	187	146	70	7.5	2,501	777
9	187	146	66	7.5	2,480	738
1960	206	148	72	8.1	2,536	654
1	231	189	73	9.2	2,507	769

Sources: (a) D.B.S. Mineral Statistics of Canada.
 (b) D.B.S. Trade of Canada.
 (c) American Bureau of Metal Statistics.
 (d) North American consumption -
United States: American Bureau of Metal Statistics.
Canada: D.B.S. Mineral Statistics of Canada.

Aluminum Production, Exports and Consumption
1900-1961

Year	C a n a d a			Production	World	North
	(a)	(b)	(a)	as % of	(c)	American
				World		(d)
				Production	Exports	Consumption
	(in thousands of short tons)			(in thousands of short tons)		
1900	-	-	-	-	8	-
1926	20	13	-	9.0	216	-
1939	83	71	11	10.4	793	178
1950	397	336	64	24.1	1,650	962
1	447	354	86	22.4	1,995	1,062
2	500	413	90	22.0	2,268	1,163
3	548	460	92	20.1	2,728	1,634
4	558	469	80	18.0	3,105	1,777
5	613	511	92	17.7	3,472	1,846
6	620	509	92	16.7	3,723	1,874
7	557	479	78	14.8	3,753	1,854
8	634	484	102	16.2	3,912	1,913
9	594	505	89	13.2	4,496	2,236
1960	762	552	106	15.2	5,002	1,792
1	663	487	127	13.4	4,943	2,176

Sources: (a) D.B.S. Mineral Statistics of Canada.
 (b) D.B.S. Trade of Canada.
 (c) American Bureau of Metal Statistics.
 (d) North American consumption:
United States: American Bureau of Metal Statistics.
Canada: D.B.S. Mineral Statistics of Canada.

Asbestos Production, Exports and Consumption,
1926-1961

Year	C a n a d a			Production as % of World Production	World Production excl. U.S.S.R.(d)	North American Apparent (e)
	(a) Production (in thousands of short tons)	(b) Exports (in thousands of short tons)	(c) Apparent Consumption (in thousands of short tons)			
1926	279	278	1	-	-	-
1939	365	346	19	74.6	489	275
1950	875	830	45	73.8	1,185	774
1	973	942	31	73.2	1,330	828
2	929	902	27	70.4	1,320	780
3	911	879	33	72.0	1,265	776
4	924	888	36	71.6	1,290	761
5	1,064	1,002	62	70.2	1,515	844
6	1,014	964	50	68.1	1,490	779
7	1,046	1,031	16	66.2	1,580	739
8	925	867	59	61.7	1,500	744
9	1,050	1,014	37	63.3	1,660	791
1960	1,119	1,069	50	63.6	1,760	759
1	1,172	1,117	54			

Sources: (a) D.B.S. Mineral Statistics of Canada.
 (b) D.B.S. Trade of Canada.
 (c) Production less exports.
 (d) World production excluding U.S.S.R. from United States
 Bureau of Mines, Minerals Yearbooks.
 (e) North American apparent consumption:
United States: United States Bureau of Mines; Minerals Year-
 books
Canada: apparent consumption, column (c)

Uranium - Canadian and World Production
1956-1961
lbs U₃O₈

Year	Canada Production(1)	World Production (2)	% Canada of World
1956	2,281	14,470	15.8
1957	6,636	23,470	28.3
1958	13,403	36,450	36.8
1959	15,892	36,250	43.8
1960	12,748	41,174	31.0
1961	9,822		

Sources: (1) D.B.S. Mineral Statistics of Canada. Quantities
 not available for publication prior to 1956.
 (2) Free World Estimate from United States Bureau of
 Mines; Minerals Yearbook.

Effect of Taxes on Calculation of Present Value

Example (1)	Marginally Economic Orebody										(millions of dollars)
Year	0	1	2	3	4	5	6	7	8	9	10
Cash Profit after Mining Tax		1.20	1.20	1.20	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Writeoff-Plant & Equipment (30% decreasing balance)	-	-	-	.90	.63	.44	.31	.22	.15	.35	
Writeoff - Preproduction Expense	-	-	-	.10	.37	.56	.69	.28	-	-	
Total Writeoffs for Tax Purposes	-	-	-	1.00	1.00	1.00	1.00	.50	.15	.35	
Taxable Income before Depletion	-	-	-	-	-	-	-	.50	.85	.65	
Taxable Income after 1/3 Depletion Allowance	-	-	-	-	-	-	-	.33	.57	.43	
Tax @ 52%	-	-	-	-	-	-	-	.17	.30	.22	
Cash generation	1.20	1.20	1.20	1.00	1.00	1.00	1.00	.83	.70	.78	
Discounted Value @ 15%											
\$1.04	-	-	-	-							
.91	-	-	-	-							
.79	-	-	-	-							
.57	-	-	-	-							
.50	-	-	-	-							
.43	-	-	-	-							
.38	-	-	-	-							
.27	-	-	-	-							
.20	-	-	-	-							
.19	-	-	-	-							
<hr/>											
\$5.28											
<hr/>											
Costs:											
Preproduction costs	\$2.00										
Plant & Equipment	3.00										
Working Capital	.28										
<hr/>											
	\$5.28 million										

In the above example, return of capital together with 15% interest, after tax, is achieved on the \$5.28 million investment.

Example (2) Same Orebody; but without the special tax incentives (i.e. no tax free period or depletion allowance, and writeoffs on the average @ 15% rate declining balance)

The orebody in example (1) must now become submarginal. The addition of ore reserves of the same grade fails to compensate for the loss of the special tax incentives.

(millions of dollars)															
Year -	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14 -->
Cash profit after Mining Tax	1.20	1.20	1.20	1.20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Writeoff (15% declining balance)	.79	.67	.57	.49	.41	.35	.30	.26	.22	.18	.16	.13	.11	.10	
Taxable Income	.41	.53	.63	.51	.59	.65	.70	.74	.78	.82	.84	.87	.89	.90	
Tax @ 52%	.21	.28	.33	.27	.31	.34	.36	.38	.41	.43	.44	.45	.46	.47	
Cash generation	.99	.92	.87	.73	.69	.66	.64	.62	.59	.57	.56	.55	.54	.53	
Discounted value @ 15%															
\$.86	.70	.57	.42	.34	.29	.24	.20	.17	.14					

\$3.93 million for 10 years; or \$4.79 million for 50 years

The present value @ 15% of the above series will not reach \$5.28 million even though the life of the orebody be extended for hundreds of years. Without the tax incentives, development of this property is not possible.

Example (3) Again without special tax incentives, but with a higher grade orebody than in example (1), so that cash profit after mining tax is 50% greater.

(millions of dollars)											
Year -	0	1	2	3	4	5	6	7	8	9	10
Cash Profit after Mining Tax		1.80	1.80	1.80	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Writeoff (15% declining balance)		.79	.67	.57	.49	.41	.35	.30	.26	.22	1.22
Taxable Income		1.01	1.13	1.23	1.01	1.09	1.15	1.20	1.24	1.28	.28
Tax @ 52%		.53	.59	.64	.53	.57	.60	.62	.64	.67	.15
Cash generation		1.27	1.21	1.16	.97	.93	.90	.88	.86	.83	1.35
Discounted Value @ 15%		:	:	:	:	:	:	:	:	:	:
\$1.10 - - - - -		:	:	:	:	:	:	:	:	:	:
.91 - - - - -		:	:	:	:	:	:	:	:	:	:
.76 - - - - -		:	:	:	:	:	:	:	:	:	:
.55 - - - - -		:	:	:	:	:	:	:	:	:	:
.46 - - - - -		:	:	:	:	:	:	:	:	:	:
.39 - - - - -		:	:	:	:	:	:	:	:	:	:
.33 - - - - -		:	:	:	:	:	:	:	:	:	:
.28 - - - - -		:	:	:	:	:	:	:	:	:	:
.24 - - - - -		:	:	:	:	:	:	:	:	:	:
.33 - - - - -		:	:	:	:	:	:	:	:	:	:
<u>\$5.35</u>											

To compensate for the loss of the special tax incentives, no less than 50% increase in cash profits from higher grade ore must be anticipated to make the orebody marginally economic as in example (1).

